ELECTRICAL REVIEW

[ILLUSTRATED.]

A WEEKLY JOURNAL OF

ELECTRIC LIGHT, TELEPHONE, TELEGRAPH AND SCIENTIFIC PROGRESS.

(*Formerly Review of Telegraph and Telephone.*)

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The Sawyer-Man Lamp of the Consolidated Electric Light Company.

The steady and continued increase of demand for their electric light that the Consolidated Electric Light Company of this city has secured during the past year, has been brought about by the excellence of the lamp which we illustrate in this issue, the success of the company in securing an important patent after a five-years' fight with the Edison Company, and last but not least, the sensible business principles that the present management have pursued. We desire to call the attention of our readers to the two cuts of the incandescent lamp which appear on this page, Fig. 1 showing the switch and positive screw connection which holds the lamp bulb firmly against the socket, making a strong and sure union of the conductors. The screw is a particular advantage, as it secures the lamp to the socket in such a manner that all danger resulting from jarring is removed and besides is very convenient in changing the lamps, which by means of the screw can be done instantly, and yet, be well done. In Fig. 2 is shown the complete lamp two-thirds the natural size.

Motive Power for Cars.

The statement made by the president of the South Boston Horse Railway Company, relative to the defects of the cable system of transportation, is well worthy of consideration. The great majority of people are much too apt to jump at conclusions without a sufficient study of the premises, and it has been assumed that because cable lines are in use in other cities, therefore they are a decided improvement on other systems of street travel. But there is some reason for believing that the cable system is still in its experimental period. That it is in many ways, and, possibly, in all respects, superior to transportation by horse-power, may be admitted; but there is decided doubt as to its advantages compared with some of the systems which use eletricity for motive power. The cable which supplies the motive power to cars on a cable road has to be renewed at short intervals of time, and this renewal involves a large outlay of money, while there must necessarily be a considerable waste of power in maintaining at all times the rotary motion in a long line of steel or iron cable. Now it is believed that a large part of this expense can be avoided by the use of electric motors; and, certainly, before spending hundreds of thousands of dollars in the work of building a cable road system, the street railway companies of this city, either separately or jointly, would do well to carefully consider the advantages which might result to them from the use of electric motors.—*Boston Herald.*

⁂ Underground wire has long ceased to be an experiment in Germany and France, the former having in all 15,000 miles, and the latter over 7,000. The cables used are similar in construction to the submarine cables, and are laid in deep trenches, imbedded in a bituminous layer of condensed coal tar. The Dorsett conduit system in use in this city is an improvement over the French and German methods of laying underground wires.—*Chicago Western Manufacturer.*

Electric Motors.

As an early user of motors, dating back so far as 1874, and ever since, a few words on this subject may be acceptable, seeing how much space is being devoted to this topic in your journal at this moment. The conclusions to which I have come are the following:

The essence of a good dynamo is the essence of a good motor. Each can be used in turn as generator and motor with efficiency, and if this is not the case the machine is to be condemned. My experiments run over at least twenty machines, and although the tests on this head have been rough, yet they are conclusive. I am able to test the capacities of dynamos to a nicety, but not so with motors, so my practice is to "run them to ground"—that is, keep putting work on till the current reaches the carrying power of the wire. The results are surprising. Some motors will do double the work of others, although made for generators of equal power, and in some instances by the same maker. But in all cases the best motor made the best generator.

The manufacturers' tests are valueless for the workshop, and this is what so many will not recognize. No doubt a continual strain on the brake gives a result for the laboratory, but in a workshop matters are very different, one machine after another is put on or taken off, and the motor is greatly jerked and strained. Some motors "tear away" one moment and are nearly "pulled up" the next. The commutator suffers heavily in consequence, as well as the motor itself and the generator. I believe had it not been for this motors would have crept into all manufactories.

FIGS. 1 AND 2.—TWO VIEWS OF THE INCANDESCENT LAMP OF THE CONSOLIDATED ELECTRO LIGHT CO. (SAWYER-MAN).

To avoid these difficulties manufacturers have given great speeds to their motors as compared with their dynamos, and it is mainly in this respect that motors have till recently differed from dynamos, *i. e.*, the armatures were wound to have lower resistance and more carrying power. By this device the great variations in speed were in a way mastered, when work was thrown on and off; but these motors are difficult to start properly, even with resistances, and they are not very satisfactory in other respects. Such principles are an attempt to make the motor do what the equivalent size in dynamos could do, and would be condemned if such speeds were necessary.

For myself, a successful motor is of immense importance, for all the work here is done by means of them.

Till recently none have been satisfactory on all points, and inconvenience was caused every few days by some new adjustment being required to one motor or another. I have lately added two Elwell-Parker motors, which are built on scientific principles, and nothing really novel about them; but the effect is marvelous, no running away, no sparking, start as easily as possible, they do the same work as before with half the current and far more steadily, they do not shake the house at points 50 yards from the motor—in fact, there is no vibration six inches off; so I am well satisfied. The chief points about each motor are these: Very well constructed electrically, the center of gravity is very low, a broad base to rest on, speed moderate (same or rather less than for corresponding size dynamo), the armature perfectly balanced. This latter is what gives more trouble than can be supposed if absent. Vibration is produced, which is conducted to shafting and machines, till everything in a workshop gets out of truth. All my pulleys are ruined through badly balanced motors, and nearly every one has been replaced. The want of balance is even reflected to the generator, because the current becomes vibratory in character "in time" to the motor.

I will not name the makers of these motors, but may say that they stand high in public estimation.

We have eight or ten motors running here, and depend upon them entirely, so that any perfect machine is welcomed. The Elwell-Parker motors referred to are one and four horse-power nominal, but give far more power; in fact, the four horse-power at half the current intended for maximum does more work than the motor displaced did at near maximum, *i. e.*, current actually used in the two cases was at 20 to 45 amperes at 100 volts in each case.

There has been a tendency in manufactories to use large motors, and to distribute by means of shafting. This is right enough for a steam-engine, but for electro-motors it is a mistake. It is fair to assume that from the steam-engine to the latter, 50 per cent. of the power is lost for electrical means of distribution. This seems bad, but no one considers the loss of power by the use of heavy shafting. I think it will be found 30 per cent. of loss is below the mark, for in factories shafting is not always so well attended to as it should be, and alignment right at first soon alters and is "out of mind."

Now, with a steam-engine, it must always run the whole of the main shafting; but if a small motor is placed to every machine throughout the factory, only the machine itself need run, or with its countershaft if required, and at such moments only when this machine is in use and at any desired variation of speed, if arranged for this. It is far easier to switch a current on and off than to shift a belt, and the factory roof may be lighter in construction by the absence of countershafting and shafting, and this process is clearly much more economical.

I have conducted experiments of a ludicrous kind to show the economy, viz., a gas engine running a dynamo in the same shop as the machines with small motors, and this showed a saving in gas over running the same machines with the shafting which existed direct from the gas-engine.

This was a rough test, but a practical one, for the shafting was of the most modern kind.

The only difficulty to contend with was to find a satisfactory motor which would run smoothly, not spark, and be efficient besides. This appears now to have been found. I dare say that some readers may think that I have the firm of Elwell-Parker on the brain after my letter published in your sister journal last week, but it is not the case. The fact is that most of the leading and old-established firms have plenty of work in hand, and at all times view new departures with suspicion and dislike, because of the expense of altering standards, tools, and templets; whereas a new company starts with all the experience of the old ones, and, not being tied down by precedent, starts fair to meet new exigencies, if the managers are clever people. And it is with such advantages that Messrs. Elwell-Parker have started, and they will no doubt "wake up" the old firms to "move on" likewise.—*David Salomons.*

⁂ He blamed it on the telephone of course. "We feel," writes a Western editor, "that an apology is due to Widow Grimes. In our issue of last week we stated that she had eloped with an eighteen year old man. The truth is that she was thrown from an eight year old mare, while she was riding in a lope, and which slipped and fell. Mistakes will happen in the best regulated newspaper offices, and we are confident that when we state the item was sent over a telephone wire no other apology will be needed."

American Institute of Electrical Engineers.

For information of inquirers, we publish the rules of this association.

Amended December 8th, 1885.

I.

OBJECTS.

The objects of the American Institute of Electrical Engineers are, to promote the arts and sciences connected with the production and utilization of electricity, and the welfare of those employed in these industries, by means of meetings for social intercourse, the reading and discussion of professional papers and the circulation, by means of publications among its members and associates, of the information thus obtained.

II.

MEMBERSHIP.

The institute shall consist of members, honorary members and associates. Members shall be electrical experts, electricians, or electrical engineers possessing such knowledge of the principles of electrical science and such familiarity with the practical applications of electricity, in its several branches, as those branches imply.

Honorary members shall be recommended by at least ten members or associates, and elected by the unanimous vote of the council, but shall not be entitled to vote or serve as members of the council.

Associate members shall be such persons as are or have been connected with the utilization of electricity, or who, by means of study or experimental investigation, are qualifying themselves to become identified with electrical science, and such others to whose admission no objection shall be made by any member of the council.

Proposals for admission shall be indorsed by at least three members or associates, and referred to the council, which shall have power to elect to associate membership only.

All members and associates shall be equally entitled to the privileges of membership.

Transfers from associate membership to membership may be made by the council upon application, subject to the approval of a board of examiners, which shall have the power from time to time to provide rules to test the qualifications of applicants. Such rules must be approved by the council. Any person rejected by the board shall have the right of appeal first to the council, and finally to any meeting of the institute.

The board of examiners shall consist of five members (three of whom shall constitute a quorum), who shall be appointed by the president and approved by the council. They may not be members of the council, and at least three of them must reside within convenient distance of New York city.

Any member or associate may be stricken from the list by the vote of three-fourths of the members of the council, due notice having been mailed in writing by the secretary to the said member or associate.

III.

DUES.

The entrance fee shall be five dollars for each person. The dues of members and associates shall be ten dollars per annum, payable in advance, at the annual meeting, except that new associate members elected shall pay in advance, *pro rata*, from the first of the month of their election until the next annual meeting. Honorary members shall not be liable to fees and dues. Any member or associate may become, by the payment of one hundred dollars at any one time, a life member or associate, and shall not be liable thereafter to annual dues. The dues of members residing in foreign countries—beyond the seas—shall be five dollars per year, but such members shall have no vote for election of members. Any member or associate in arrears may, at the discretion of the council, be deprived of the receipt of publications, or stricken from the list of members when in arrears for one year; *provided*, that he may be restored to membership by the council on payment of all arrears, or by re-election after an interval of three years.

IV.

OFFICERS.

The affairs of the institute shall be managed by a council, consisting of a president, six vice-presidents, twelve managers, a secretary and a treasurer, who shall be elected from among the members and associates of the institute at the annual meetings, to hold office as follows:

The president, the secretary and the treasurer for one year (and no person shall be eligible for immediate re election as president, who shall have held that office subsequent to the adoption of these rules, for two consecutive years), the vice-presidents for two years, and the managers for three years; and no vice-president or manager shall be eligible for immediate re-election to the same office at the expiration of the term for which he was elected. At each annual meeting a president, three vice-presidents, four managers, a secretary and a treasurer shall be elected, and the term of office shall continue until the adjournment of the meeting at which their successors are elected.

At the first meeting for the election of officers, a president, three vice-presidents to serve one year, three vice-presidents to serve two years, four managers to serve one year, four managers to serve two years, four managers to serve three years, a treasurer to serve one year, and a secretary to serve one year, shall be elected.

The duties of all officers shall be such as usually pertain to their offices, or may be delegated to them by the council or institute; and the council may in its discretion require bonds to be given by the treasurer. At each annual meeting the council shall make a report of proceedings to the institute, together with a financial statement.

Vacancies in the council may occur by death or resignation; or the council may by a vote of the majority of all its members, declare the place of any officer vacant, on his failure for one year, from inability or otherwise, to attend the council meetings or to perform the duties of his office. All vacancies shall be filled by the appointment of the council, and any person so appointed shall hold office for the remainder of the term for which his predecessor was elected or appointed; *Provided*, that the said appointment shall not render him ineligible at the next annual meeting.

Five members of the council shall constitute a quorum; but the council may appoint an executive committee, or business may be transacted at a regularly called meeting of the council, at which less than a quorum is present, subject to the approval of a majority of the council, subsequently given in writing to the secretary, and recorded by him with the minutes.

V.

ELECTIONS.

The annual election shall be held in the city of New York, on the third Tuesday in May of each year. Nominations for officers may be made in writing to the secretary at any time previous to the meeting, but the votes shall be by ballots deposited only by members actually present. *Provided*, that no member or associate in arrears since the last annual meeting shall be allowed to vote until the said arrears shall have been paid. If for any reason it is deemed proper to postpone the election, it may be adjourned from day to day with the consent of two-thirds present or voting.

VI.

MEETINGS.

The annual meeting of the institute shall take place on the third Tuesday of May, at which a report of the proceedings of the institute, and an abstract of the accounts shall be furnished by the council. Two other regular meetings of the institute shall be held in each year, at such times and places as the council shall select, and notice of all meetings shall be given by mail, or otherwise, to all members and associates, at least twenty days in advance. Special meetings may be called whenever the council sees fit; and the secretary shall call a special meeting on a requisition signed by fifteen or more members. The notices for special meetings shall state the business to be transacted, and no other shall be entertained.

Every question which shall come before any meeting of the institute, shall be decided, unless otherwise provided by these rules, by the votes of a majority of the members then present. Any member or associate may introduce a stranger to any meeting; but the latter shall not take part in the proceedings without the consent of the meeting.

VII.

PAPERS.

The council shall have power to decide on the propriety of communicating to the institute any papers which may be received, and they shall be at liberty, when they think it desirable, to direct that any paper read before the institute shall be printed in the transactions. Intimation, when practicable, shall be given at each general meeting of the subject of the paper or papers to be read, and of the questions for discussion at the next meeting. The reading of papers shall not be delayed beyond such hour as the presiding officer shall think proper; and the election of members or other business may be adjourned by the presiding officer, to permit the reading and discussion of papers.

The copyright of all papers communicated to, and accepted by, the institute, shall be vested in it, unless otherwise agreed between the council and the author. The author of each paper read before the institute shall be entitled to twelve copies, if printed, for his own use, and shall have the right to order any number of copies at the cost of paper and printing, provided said copies are not intended for sale. The institute is not, as a body, responsible for the statements of fact or opinion advanced in papers or discussions at its meetings, and it is understood that papers and discussions should not include matters relating to politics or purely to trade.

VIII

AMENDMENTS.

These rules may be amended at any regular meeting by a two-third vote of the members present, provided that written notice of the proposed amendment shall have been given at a previous meeting.

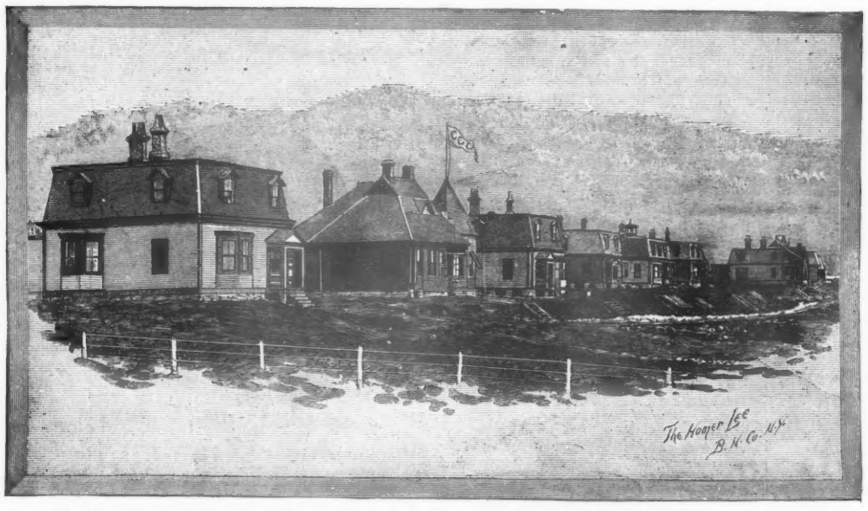

FIG. 2.—THE COMMERCIAL CABLE COMPANY'S STATION, "HAZELHILL," CAPE CANSO, NOVA SCOTIA.

Something About Duplex Lamps.

BROOKLYN, March 1, 1886.

Editors Electrical Review:

DEAR SIRS: I have read with much interest your reports of the proceedings of the National Electric Light Convention in Baltimore. Much was said and done which was of great interest to the profession at large, and while heartily agreeing with what was said and done, still there appears to me to be some points which would require a little further elucidation. Among the first is the statement made by Mr. E. R. Weeks in his article on Operating Expenses, in which he states that "single lamps, with larger carbons, even where they must be retrimmed during service are more economical than the duplex lamps. The globes on the latter are more expensive and more frequently broken. The unequal expansion produced by heating the side adjacent to the arc and the sudden change of temperature by the shifting of the arc to the other side always lead to this result in double lamps. Moreover, owing to the crowded condition of the box of the duplex lamp, it is more apt to get out of order and is more difficult to readjust; and as carbons are not uniform in their lasting qualities, the loss from burnt holders reaches it maximum where this lamp is used." I select this paragraph from this interesting paper not in a fault finding spirit but because I feel that it may convey a wrong impression as to the value and economy of the duplex lamp. I think it is evident, without argument, that any lamp which needs to be retrimmed during service is less economical than one which needs no retrimming, other conditions being equal. There is no necessity for the globes in the duplex lamps being more expensive than those used in the single lamps; it being perfectly possible to arrange the lamps so that the same globe can be used on both, and as for the breaking by the nearness of the heat of the arc to one side or the other I may be wrong, but I can only say that during considerable experience in the use of duplex lamps, in a large city installation, I have never lost a single globe from this cause, and I see no good reason why it should be so. The most fruitful cause of loss of globes is the necessity for removing them from the lamps during trimming, and all lamps should be so arranged that it is not necessary to remove the globes to trim them. As regards the crowded condition of the duplex lamp box rendering it more liable to get out of order, this may be so in some lamps, but I think the cause for getting out of order is more frequently in the character of the shifting apparatus by which the current is diverted from one side of the lamp to the other. Some of these devices are so fearfully and wonderfully made that I

sometimes wonder how they work at all successfully. A properly constructed duplex lamp should be as simple in its construction as a single lamp, and the shifting apparatus be of such a character as to preclude any possibility of derangement. It should be purely mechanical in character and positive in action, and above all not depend on any magnetic action to set it in motion. There are carbons and carbons—good, bad and indifferent—and it behooves those who use them to select only such makes as have been tried by experience and proved to be up to the required standard. Such carbons are made, I believe, and I have found no trouble when they are used, and all lamps should be so arranged that it would be impossible, under any ordinary trimming, to loose carbon holders by being burnt out.

To sum up, I believe that with a properly-arranged duplex lamp a greater economy can be obtained than by the use of a single lamp in all places where the length of time during which the lamp is required to operate precludes the use of the single lamp. All of the before-mentioned objections have been met in the duplex lamp of my construction, and I am speaking from experience in making the foregoing remarks.

E. R. KNOWLES,
Electrician Brooklyn Electrical Construction Co.

Interview with Superintendent Easterlin of the Southern Bell Telephone Co.

A reporter for the Charleston, S. C., *News and Courier* recently called upon Mr. J. D. Easterlin, District Superintendent of the Southern Bell Telephone Company, and the following interview ensued:

"Mr. Easterlin, having recently published in our paper an advertisement of the company you represent, calling attention to the fact that you are not the American Bell Telephone Company, about which so much has recently been published in the newspapers, I thought I would call around and get you to explain to me the relations of your company to the one named. Why are there so many Bell Telephone Companies in the country?"

Mr. Easterlin—"Because when the telephone was first invented it was not as fully appreciated as after-facts have shown it should have been, and the American Bell Telephone Company, which was organized at Boston for the purpose of developing the enterprise, had great difficulty in placing its stock, and as it had bitten off more than it could chew, it was quite willing to grant licenses, upon advantageous terms, to sub-companies and individuals to work the country, assigning to each a certain section. These sub-companies went to work, built exchanges and developed the business to its present size."

"Yours, I believe, is called the Southern Bell Telephone and Telegraph Company. Will you tell me what section of the country is covered by your franchise?"

Mr. Easterlin—"Yes, sir. Our territory embraces the States of Virginia, West Virginia (south of the Baltimore and Ohio Railroad), North and South Carolina, Georgia, Florida and Alabama."

"How do your rates compare with those of the North and West?"

Mr. Easterlin—"Recently the board of trade of a neighboring city, believing that their city was being discriminated against, instituted an investigation into the matter, and the results of their labor show that the average price paid for telephone service at places of business within the United States is a fraction over $71; our average price is less than $60."

"In regard to the telephone litigation now going on, can you give me your views as to the probable results?"

Mr. Easterlin—"As a matter of fact the Southern Bell Telephone and Telegraph Company being only a licensee of the American Bell Telephone Company, my knowledge either personally or as an officer of the former company is quite limited, not more than that of any intelligent outsider who has kept himself posted by reading both sides. However, I will say the American Bell Company claim, as you have doubtless seen, that there are three or more suits on the docket of the Supreme Court where infringing companies, having been enjoined by the District Courts on suits brought by the Bell Company, have appealed to the Supreme Court. Some of these suits, had it not been for the interference of the Attorney General, would have been up for consideration by this high tribunal in a short while, but the action referred to will have the effect of delaying them, and giving the infringing companies, who have not as yet been enjoined, more time in which to place their worthless stock upon the public. I have been informed that the Bell counsel has urged the Attorney General, without success, to join them in a request to have these suits advanced on the docket so that an early decision could be had. It is a matter of record that so far as decisions have been reached, they have been in favor of Bell, both in the Courts and Patent Office. In the latter the matter has been reviewed within a year or so, in connection with some interferences."

"I presume that when the patent runs out, which I understand will be within the next six or seven years, your prices for telephonic service will be very much reduced?"

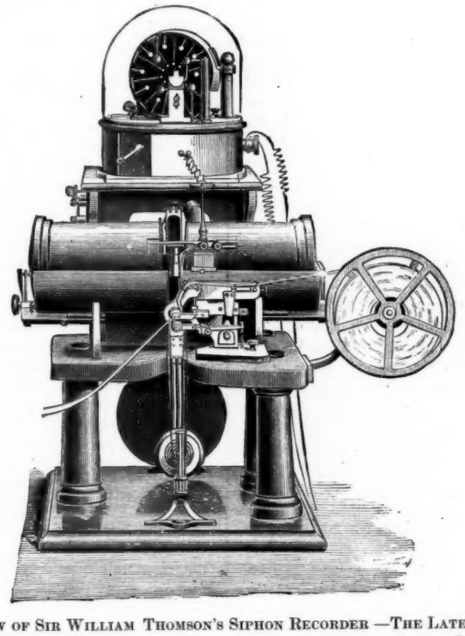

FIG. 1.—VIEW OF SIR WILLIAM THOMSON'S SIPHON RECORDER—THE LATEST DEVELOPMENT IN OCEAN TELEGRAPHY.—USED ON THE COMMERCIAL CABLE SYSTEM.

Mr. Easterlin—"We can't cross that river until we come to it. Possibly the rates will be somewhat reduced. The general public have very exaggerated opinions as to our profits, and excusably so, as we believed when we went into the business that enormous dividends were ahead of us. These, however, have not materialized. Telephone stocks to-day do not pay as much as those of many other kinds of business. Our company has been managed as economically as possible, and we have only been able to average about four per cent. dividends."

"Is any of your stock owned South?"

Mr. Easterlin—"Yes, sir, we have a good many stockholders on our territory, several of them being residents of this city, and one of them quite a heavy holder."

Mr. Easterlin, continuing, said—"We are not so much interested in the battles of the American Bell Company as we are that the newspapers should take pains to ascertain the truth of statements in regard to the business, as conducted by the sub-companies, before publishing them as facts. They would not, then, be so apt to make wild assertions calculated to prejudice the public against their fellow-citizens who are trying to give them a good, honest service for reasonable, in many cases too low, pay. For instance, the New York *World* has been printing some outrageous distortions of figures and facts about the business, calculated to promote a communistic spirit, citing fortunes made by various parties which no one can verify. One reckless statement in regard to the licensed companies is that there is not one of them but got back the cost of its construction the first year. The fact is that probably not one of them did that; certainly this company has not gotten back the cost of its construction in six and a half years. We ask for fairness and justice on the part of the press, the same as is accorded other branches of legitimate business, and we shall endeavor to give the public as good service at as low rates as can possibly be done."

Electrical Language.

Editors Electrical Review:

During my study of electricity, I have time and again been misled and puzzled by the many false terms commonly used in this branch of science. I refer to the gross looseness and inaccuracy of language so often met with in daily papers and periodicals. My patience, however, reached its bounds as I read in an article headed "The Electric Light in Private Houses," in the ELECTRICAL REVIEW for Jan. 23, 1886, the following statement: "The house, including bedrooms, is lighted by fifty Swan incandescent lamps of fifty volts and twenty candle-power each, burning a current of 1.3 amperes per hour." How such language ever found its way into the ELECTRICAL REVIEW is to me incomprehensible.

That which is commonly called a "current of electricity" *cannot* be burned, neither can there be any connection whatever between *amperes* and *hours*, in the above case.

For the sake of the science, as well as those who study the same, I would beg most earnestly that all possible resistance be brought to bear on this inflow of loose and meaningless expressions. Let us introduce into this current an infinity of ohms, and I feel assured that we shall never again hear of amperes per hour, year or any number of years.

Very respectfully yours,
ALEXANDER WURTS.

HANOVER, Germany, Feb. 10.

[The article which has disturbed our friend in Hanover, was written by Chas. J. Phipps, F. S. A., of England. ED. REVIEW.]

* * The National Electric Mail Box Manufacturing Company, Camden, N. J., has been organized with a capital stock of $100,000. Samuel W. Wray and others, incorporators.

Sir Wm. Thomson's Siphon Recorder.

The siphon recorder shown in this engraving is rapidly taking the place of the mirror galvanometer for ocean telegraphy, for the reason that it enables the operator to glance twice at any doubtful signal, thereby saving many errors.

The recorder is really a galvanometer reversed, instead of an electrical impulse passing through a coil of wire, moving a small magnet suspended in the center of it, as is the case with a galvanometer; the recorder has the coil suspended and moveable, the magnet being stationary. In the engraving the large horizontal cylinders are the two legs of a powerful electro-magnet, the iron trough in which they are placed forming the heel of the magnet. By placing them in this position the two poles come directly opposite and the lines of magnetic force are concentrated directly upon a small piece of iron, about 2 inches long by ¾-inch broad, which is rigidly fixed between them; the poles of the magnet never being allowed to come closer to the small piece of iron than ⅛ of an inch, there are two narrow but very intense magnetic fields created. Round this small iron core and passing through the magnetic fields, is suspended a coil of very fine copper wire; the coil is of such a size as to move with perfect freedom whenever an electrical impulse passes through it.

In front of the large electromagnets will be seen a small insulated horizontal bar, to the ends of which a fine platinum wire is strung, and upon it is fastened the siphon, which is also connected by a silk fiber to the suspended coil. The siphon is a glass tube about two inches long and one hundreth of an inch in diameter; the lower end of it can be seen pointing toward the paper slip, just over a wheel, whose duty is to draw the slip along steadily.

The electrical impulses over a long cable are very feeble and if the siphon rested upon the paper ever so lightly the friction would be sufficient to prevent its moving laterally in obedience to the cable currents. The friction upon the paper was surmounted in the following manner by the use of static electricity. Above the large magnets and under the bell glass cover is an electro motor whose duty is double; first, to turn the wheelwork which draws the paper; secondly, to generate static electricity by induction upon its surrounding plates. Attached to the small insulated horizontal bar, from which the siphon is suspended, is the ink-pot into which the upper end of the siphon dips. The static electricity generated by the motor is conducted to the ink-pot, charging it and the siphon so strongly that when the paper is drawn back about one-sixteenth of an inch the siphon is attracted until, touching the paper, it leaves an imprint of its point, and having at the same time discharged itself, it flies back to its former position, only to be again attracted towards the paper; these attractions keep on steadily at about the rate of 90 per second, each one leaving a dot of ink. When no current is passing through the suspended coil, the siphon marks simply a continuous straight dotted line along the paper, but as soon as a signal is sent by the distant station the coil moves, dragging with it the siphon and making a lateral mark across the paper. A movement of the siphon in a direction from the operator, represents a dot, and a movement in the opposite direction, a dash.

The continental Morse characters are used, and are readily deciphered over the long cables at the rate of twenty words per minute.

* * A peculiar feature of one of the latest electrical stoves invented in France is that apertures are formed in plates of refractory clay and plumbago, through which the wires are led; these plates are not inclosed, but are left exposed, so that the air can circulate very freely through and through the apertures, where it comes in contact with the redhot wires; wire bobbins are inserted in the apertures; each bobbin forms part of the electric circuit, and all are connected for quantity, these bobbins being, of course, heated by the passage of the current, and serving to heat the air as it passes to and fro over them.

Electrical Review.

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We invite correspondence from Electricians, Inventors and the Telegraph and Telephone fraternity and those engaged in Electric Lighting on matters pertaining to electrical and scientific subjects, and all facts of special interest in connection therewith.

We extend to manufacturers of electrical apparatus an invitation to send to this office any and all facts concerning their business which will be of interest to the public. We make no charge for publishing news.

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NEW YORK, MARCH 20, 1886.

CONTENTS.

	PAGE
Sawyer-Man Lamp	1
Electric Motors	1
American Institute of Electrical Engineers	2
Duplex Lamps	2
Charleston Telephone Company	3
Electrical Language	3
Sir Wm. Thomson's Syphon Recorder	3
Editorial Notes	4
Present Condition of the Telephone Business	4
General Western News	4, 5
Boston Electrical News	5
Pennsylvania B. & O. Co	5
Telephonic News	6
San Francisco Messenger Business	6
Barrett's Strong Current Protector	6
"History of the Progress of Electric Lighting"	7
Underground Wires	9
Western Union Telegraph Co	9
Electric Light News	9
Electrical Patents	10

The Congressional Committee appointed to investigate the Pan-Electric telephone scandal is now sitting in Washington, listening to the testimony of interested parties. The evidence promises to be quite lengthy as well as interesting.

The other day old Dave received a telegram from a man down in the country who wanted him to come down and clean out his well. After some one had read the dispatch to the old man, he said: "De Lawd hab mussy on sich a man as I is. Gettin' more 'portant ebery day. Get a letter yesterday, an' now I'se dun get a 'spatch. Uh, huh! When da kaint reach me wid a post-office da stretches ar er me wid de tillygraph wires."

A bill has been introduced in the Maryland Senate giving the telephone and telegraph companies the right to obtain by means of a jury of condemnation authority to put their wires underground without the consent of the Mayor and city council of Baltimore. In a great many cities that we know of, the electric companies would feel very happy and contented to have a Mayor and city council opposed to underground wires.

There are subscribers to the telephone exchange in Indianapolis who now wish their State Legislature had displayed more wisdom and less knowledge. They want their telephones back.

The fact that General Manager Sargent, of the Brooklyn Telephone Company, intends to use the Dorsett conduit indicates a probable solution of the underground question from a telephonic standpoint. We learn, in addition, that the American Telephone and Telegraph Company have decided to adopt this conduit to carry their wires from the suburbs of Philadelphia into the heart of the city.

On Saturday last the "Turnbull" telephone was tried over the Baltimore and Ohio Telegraph Company's lines between this city and Washington, and the result of the test is reported to have been very successful. The Baltimore and Ohio Company is an enterprising and popular telegraph company, but if it intends to put this city on conversational equality with Washington and flood us with the so-called eloquence that has in the past been buried in the *Congressional Record*, there will be a turn in popular sentiment at once disastrous to the company and discouraging to the bright electricians now so earnest in their telephonic advance.

On page 13 of this issue our readers will find several interesting and important statements made to the public by the Consolidated Electric Light Company (Sawyer-Man), in which the pretentious claims of the Edison Company are punctured with neatness and dispatch. The peculiar methods of the latter company, in which brag and bluster and threats against other companies and their licensees have been chiefly prominent, have finally induced the owners of the Sawyer-Man patents to take their present sure and decided stand.

THE PRESENT CONDITION OF THE TELEPHONE BUSINESS.

The Indiana telephone troubles, coming as they do at the present time, are anything but encouraging to parties interested, not only in the companies operating in that State, but stockholders elsewhere; and it will not be surprising if the whole matter of rights in that and other States arrays two antagonistic parties against each other, with strong communistic proclivities on the one side as against the owners and users of the telephone patents on the other.

Were it not for the complication arising out of the investigation as to the validity of Bell's patent, the Indiana question would be much easier of solution. In the normal condition of a clear title to a patent—of an exclusive right to the field in Indiana, the telephone people would hold the balance of power in their own hands, and could undoubtedly effect a compromise by resorting to a heroic school of practice by withdrawing from the State, and leaving the field, as far as telephonic facilities were concerned, in much the same condition as the cupboard of elderly Madame Hubbard when she went there in search of a bone, and the probability is that this would have been the policy adopted and carried out so far as this could be effected under the legal restraints affecting the companies.

There is, however, a drawback to this method resulting from the complication above referred to. The preliminary examination as to valid cause for proceedings looking to the mention of the Bell patent is looked upon by the anti-Bell people, not as an investigation before a grand jury, but rather as an informal conviction which only requires the endorsement of subsequent proceedings in form to become legal and binding. In the minds of these parties the vacating of the Bell patents is a foregone conclusion, and hence, inasmuch as the Bell Company never had any legal rights, no injunction will be granted against any telephone company desiring to occupy abandoned territory, and therefore the several companies, if they desire to maintain their hold upon the State, must do so by remaining on the ground and giving service at losing rates of pay until such time as the validity of Bell's case is settled.

There were, at the time of the recent decision of the Supreme Court, no less than seven telephone companies in the State.

The Ohio Valley Telephone Company, with headquarters at Louisville, Ky., controls the counties of Clarke, Floyd, Harrison and Crawford, lying along the river; the City and Suburban Telegraph and Telephone Association branches over from Cincinnati into Dearborn county, taking in Lawrenceburgh and Aurora. The Cumberland Company covers Dubois, Pike, Gibson, Warrick, Posy, Spencer, Perry and Vanderburgh counties An individual, Mr. L. Johnson, controls Knox, Greene, Shelby, Decatur, Jackson and Davies counties, including Vincennes, Shelbyville, Seymour and Bloomfield exchanges. The Chicago Company owns Lake and Porter counties, with an exchange at Valparaiso. There was a holding in Sullivan county, but this has been closed since the row began. The remaining available portion of the State is in the hands of the Central Union Company.

The New York *Times* of the 4th of March says that the Central Union is playing a bluff game in Indiana. There is no chance for a bluff game, nothing to be gained by an attempt of that sort. Here is a law prescribing certain rates for certain services, and affixing certain penalties for violations of the law. That law, while it remains on the statute book, so far as State authority or power of revoke is concerned, cannot be questioned; the highest State tribunal has affixed its seal of endorsement upon it. How then can there be any bluff game on the part of the company?

Says the *Times:* "The company's pretense that it can make no money at $3 a month rental for its telephone instruments is a humbug. * * * When a telephone instrument complete costs only $3.42, and the total average expenditure for 'plant' for each subscriber is only about $11, it is preposterous to assert that the telephone business cannot be made profitable at a charge of $36 a year to each customer." [Important, if true.]

This method of assuming a basis and predicating argument on such assumption has a remarkable flavor of the Col. Sellers type of proclamation; and no matter what facts might be offered in refutation, these statements, untrue as they are, would, like Banquo's ghost, refuse to down. Yet silence on the part of the companies is assumed to be evidence of guilt and so far as conviction of their traducers is concerned the telephone people might as well keep their own counsel as attempt to speak in their own defense. It is a case of wolf and lamb as given in the old fable, or the New England witch test; if innocent they drowned, if guilty they lived and must be burned.

Yet the Central Union and all the telephone people in the State of Indiana have adopted this "bluff" game with wonderful unanimity of thought, and, so fast as the expiration of present contracts will permit, will quietly withdraw from the field wherever under the lawful rates the expenses will overbalance the receipts.

And what may seem at first blush a little curious to the general public, is the fact that in the largest exchanges, that is, where the greatest amount of work is done, in what might perhaps be looked upon as the wholesale exchanges, this discrepancy is the widest. In the telephone business what at a glance appears to be wholesale dealing, on investigation proves in reality to be a retail business. The subscribers who are in an exchange of 4,000 will certainly use their telephones on an average many times oftener than the members of an aggregation of 40 or 400. Say each subscriber for instance, were restricted to the use of his telephone to three times per day. In the smaller of the above exchanges there would be 120 calls per diem, in the second 1,200, and in the larger 12,000 calls. If, then, we suppose that to attend the 40 subscribers fully employs one person we will have ten operators in the 400 office, and one hundred operators in the larger office to accomplish the same service.

The additional facilities for communication which the largest exchange offers naturally increases the number of calls per capita of subscribers. In the small exchange above there are only thirty-nine subscribers with which any one of the forty may converse. In the medium sized exchange each subscriber may at will call up any one of three hundred and ninety-nine, and in the exchange of four thousand, there are three thousand nine hundred and ninety-nine subscribers with which any one of the rest may converse at any time.

Now, if for a moment we consider the number of calls which are probable in a combination like this last, we can, perhaps, see how a large exchange is more expensive as well as more valuable to the individual subscribers than a small exchange.

All this has been repeatedly shown in detail, and tabulated exhibits of receipts and expenses published to verify the reasoning by facts; but of what use is all this? The communist is on parade, the red flag is waving on high, and he is bound to pull down what he cannot own, destroy what he neither did nor can build, ruin where he cannot rule.

GENERAL WESTERN NEWS.

There are *pros* and *cons* in the telephone controversy, which is now believed to be near an approximate conclusion, that are of general interest to the public. Among these the cross fire between the Bell and Gray people furnishes some of the most curious, to call them by no other name.

In a recent number of the New York *Post*, Mr. Edward N. Dickenson makes some statements which bear on the question. He says: "There is one statement of fact which, in the present heated controversy, ought not to pass without correction. That statement is that Gray's caveat exhibited a liquid transmitter similar to the one tried at the Centennial by Prof. Bell. The accusation is in these words: 'It was that form of Prof. Gray's, and not the form which Prof. Bell describes in his patent, which was one of those successfully used by Bell at the Centennial exposition of 1876, and which at that time excited so much interest and astonishment.' The fact is that it was the 'magneto telephone,' and not the liquid transmitter form which Bell exhibited, and which excited the astonishment. Gray was present on the occasion referred to, and himself talked through the Bell magneto telephone, and expressed as much astonishment as any one. His testimony on the subject is in the Dowd record, Vol. 1, p. 126, q. 53, when he was asked to describe the Bell Centennial instrument, and he described it fully as a magneto. He was asked, 'was such a combination for the purpose of a telephone transmitter new with Prof. Bell, so far as you know?' And he answered: 'It was, so far as I know,' and on cross-examination he said in reference to that telephone: 'I have no recollection of having seen any other than the one described.'"

The exhibition which made Bell famous was on Sunday, and was arranged by Prof. Barker for the purpose of exhibiting Gray's musical telephone, "adapted for the transmission of tunes." No one there had heard of Bell's "speaking telephone" till after Gray had shown his harmonic telephone, when Prof. Bell asked leave to exhibit something he had, and produced the "talking telephone," to the great astonishment of the selected scientific audience which came there for no such purpose. Mr. Gray listened to it and repeated what was spoken, as did the Emperor of Brazil, Sir Wm. Thomson and many others, and at once Bell becames famous. Prof. Watson, of Ann Arbor, who was present, published in the *Nation*, Dec. 5, 1878, a statement that Gray said in respect to this exhibition: "That we have been deceived in some way, that the transmission was by actual metallic contact through the wire," and that it was, to use his own words

"nothing more than the old Lover's Telegraph." This Gray denied when he was defending the Dowd case, in which he was a party in interest as a large owner in the defendant company, but said: "I remember saying to Prof. Barker that if the wires connecting the transmitter and receiver of Prof. Bell's apparatus were properly suspended, etc., ... that the results might possibly be obtained through the wire" (p. 143 Dowd).

Prof. Barker, who testified for the defendants in the Overland cases, says that there was no water transmitter at the Centennial exhibition; but he made this very important statement: "He (Gray) said he was much surprised that the results he had heard had been obtained with the form of transmitter Bell had used; and remarked that the effect might have been produced by mechanical transmission, although from the arrangement of the wires it was not easy to see how this was possible;" and on cross-examination, he said: "The impression that I received from Gray's remark was that on hearing the sounds in the telephone the first impression was that they had been transmitted mechanically by an actual vibration of the intervening medium, as in the string telephone, so called, but that on examining the wires they appeared to be so fastened that such mechanical transmission did not seem possible."

Per Contra—Mr. D. K. Tripp, who is Prof. Gray's attorney, has recently published some statements over his own signature, from which the following points are gleaned:

"Being familiar with the record and knowing the disposition of Elisha Gray, I believe I can state the facts in their true light. Whatever admissions may have been made by Prof. Gray and whatever he may have said in any letter written to Mr. Bell or to his attorney, Mr. Baldwin (who is now and has been for years in the service of the Bell Telephone Company), must be considered as having been made and written with the honest intent of doing absolute justice to every one; and, as his attorney, I am authorized to say that he will submit all his testimony given in the collusive cases of the past and all his letters to the judgment of the world, and if any one will point out a single word admitting that he did not invent the telephone the 14th day of February, 1876, then there may be some value in recalling his testimony. Mr. Gray has never admitted that he did not invent the telephone. It is true that Bell did not exhibit a liquid transmitter at the Centennial, and it is true that Gray testified to this—and it is also true that if Bell had a liquid transmitter he kept it out of sight at that time.

"If Bell had shown the liquid transmitter at the Centennial Gray would have been suspicious that he (Bell) had obtained some knowledge of his (Gray's) invention at that time, and would doubtless have resulted in Gray protecting himself. As it was he was deceived as to the real facts. And when he looked upon that magnificent invention he supposed that Bell had arrived at substantially the same result by a little different mode of transmitting, and had done his work without a hint or any knowledge whatever of what Gray had done."

The facts, as stated by Mr. Tripp, are:

Bell and Gray filed papers the same day, Feb. 14, 1876, the former an application for multiple telegraphy, the latter a caveat for a "talking telegraph." This last so perfectly described the instrument that from it one skilled in that class of work could have constructed a telephone. Gray's work was accomplished, so far as protecting his rights under the law were concerned, on the 14th of February, 1876.

Gray was notified to complete his application within three months, as the examiner had decided the two application were in interference. The two applications or filings occurring on the same day to determine priority rights it became necessary to divide the day—which had not been customary prior to that date. The office having decided that Bell's application was the elder, the notice of interference was withdrawn; but not until Gray had been notified.

Then Bell went to Washington, obtained a knowledge of Gray's caveat, and on the 29th of February so amended his application as to cover the ground which would shut out Gray. Bell went home in hot haste, and on the 10th of March made a telephone, from which he obtained his first transmission of articulate speech. This telephone was a liquid transmitter, like that described in Gray's caveat, and wholly unlike that described in his (Bell's) patent which had been issued three days before. So it appears that Bell actually had an instrument before Gray had made one, but from Gray's description, made by Watson, exactly as he would have made it under Gray's directions, using his own skill in working out the details.

Then Bell, not daring to use this experiment, and not daring to apply for a patent, because of Gray's caveat, took the receiver shown in Gray's caveat, and used it as both a receiver and transmitter—the form known as the "Magneto transmitter." Bell made this application, but not until after the problem had been solved by the variable resistance transmitter of Gray. Bell did not invent the magneto as an apparatus—it was not new to Gray, as he had devised and used it nearly two years before he filed his caveat in his musical instrument.

The admission of Gray referred to the magneto transmitter, and he has never admitted either in his lecture or in his letters that he did not file a complete description of a complete invention—a new art—in his caveat of Feb. 14, 1876. He has never admitted that Bell's application, filed the same day, contained the description of the telephone, but has always asserted to the contrary. Baldwin, Gray's attorney at Washington, on March 3rd (four days before Bell's patent issued) wrote to Dr. S. S. White, who was furnishing the money for Gray to perfect his harmonic system, saying that an application might be made for a patent before Bell's patent could issue, but advised against such action, because "Bell's application was sworn to Jan. 2, 1876." Gray took the advice and remained quiet and unconcerned, until he was startled at the Centennial by learning that Bell had made a telephone since his patent. On inquiry, Gray was informed by his attorney that he (Gray) had lost his rights, as Bell had actually made an instrument, and induced him to believe that Bell had actually preceded him; and believing this he was willing to withdraw his claims to that which he was led to believe belonged to another.

But for recent developments having led Gray to the belief that he had been grievously imposed upon and wronged, either wilfully or inadvertantly, at the Patent-office, he would never have opened his mouth in self defense. It makes no difference what he may have admitted or written—his eyes were closed to the real facts and to the real legal position he occupied, through the bad advice of counsel.

In conclusion Mr. Tripp says: "Prof. Gray believes he has been defrauded. Believing this, he owes it to the truth of history, to his family, and to himself that he allow the most searching investigation to be made."

From all the above may be condensed pretty much all there is of the Gray and Bell entanglement. Of course this can only affect the general question after the other general question (the latter, perhaps a major general, while the former is only a brigadier) of whether any one this side of Reiss is entitled to a patent. If the Reiss claim is substantiated, then it becomes a scrub race, as it were, where one horse—the Bell—knows the track better than the field against which he is running.

If, however, Reiss and the rest of the claimants whose foreheads are branded with dates back of 1867, are ruled out, then comes this question of priority between Gray and Bell.

In the event of a change of kings, what are we frogs to do? To take a monopoly from one and give it to another individual or company, is that a guarantee of less rates, better service or economy of breath? Will we have less chaff from operators and fewer naughty words from people who convert their transmitters into cuspidors and fog horns? If we are to have a change of masters, pray heaven the above be all considered and all amended.

Detroit, which like Buffalo quite resembles the drying yard of some giant laundry, save that there are no visible garments upon the lines, has at last wakened to the existence of overhead wires, and the initiatory steps have been taken to compel the wires to go down below. The clincher which wrought this result was a million dollar fire a while ago, the cause of which was traced to the electric light wires.

Experiments are being made upon the Chicago, Milwaukee and St. Paul road, with the Smith-Edison-Gilliland Induction train telegraph system, between Milwaukee and Chicago. This is the system generally known as the Edison system, based upon W. W. Smith's idea, patented about five years ago, of using the metal roof of a car for a condenser plate, to which the receiving or transmitting apparatus is attached through a switch in the car to ground.

S. G. Lynch, 144 La Salle street, gives the following quotations as telephone stock values:

Chicago	$375	@	$400
Central Union	50	@	51
Michigan	65	@	67
Iowa Union	14	@	17
Great Southern	25	@	30
Colorado	18	@	20
Rocky Mountain Bell	40	@	45
Missouri & Kansas	53	@	54
Missouri & Kansas, Script, 52 cents on the dollar.			
United	15	@	17
Cumberland	70	@	75
Wisconsin	110	@	112
Bell of Missouri	150	@	155

CHICAGO, March 16, 1886.

BOSTON ELECTRICAL NEWS.

At a recent meeting of the Waltham board of trade, the committee on electric lights made their report. The organization of a company will be immediately proceeded with. As soon as the plant is in working order there will be a general demand for the light in stores, halls and probably for street illumination.

The committee on street railways of the Legislature held a hearing this week on the expediency of legislation to grant street railroad companies the right to operate their roads by electricity and also distribute current for incandescent and arc lights and the distribution of power. It is claimed that under the present laws, towns and cities have a right to dictate what motive power shall be used on street railroads, and legislation is desired so that no difficulties may be in the way of a change. There was little opposition and that only on the part of the Watertown Gas Co.

It is advocated in some directions that the State laws be so changed that existing gas companies in Massachusetts may increase their plant by the addition of an electric-light system to their works without separate legislation in the case of each company applying.

Mr. M. S. Greenough of the Boston Gas Light Co., in his address as president of the New England Association of Gas Engineers, at the last meeting held at Providence, R. I., said that local gas companies should give attention to the question of adding electric lighting to their present business. He admitted the superiority of electricity in hot weather, which on account of its safety, coolness and entire control, is more desirable than gas, but that in winter the latter had the advantage.

A new form of resistance is interesting from the fact that six inches in length measure 2,400,000,000 ohms. The substance is a lead pencil mark.

The "mammoth" 125 candle-power lamps have been placed in the City Hall. The lamps are run on a Brush 60 arc-light circuit and have given such good satisfaction in the Rogers building, 209 Washington street, that they have been placed all through the corridors of that building.

There ought to be a stronger alliance between the insurance examiners and electric light companies. At present there is much misunderstanding between the electric light interests and the stock insurance companies. There is no trouble on the part of the mutual fire insurance companies, for they work with the electric people, and are a help rather than a hindrance. It is recommended that there be monthly meetings of the insurance inspectors and electric light companies' representatives; that all wiring men should be examined and have a certificate from an insurance board, and that all changes in the rules and regulations relating to the installation or operating of electric light plants should be sent to all agents and certified wirers of the electric companies. In the past plants have failed to be satisfactory to the insurance companies, because some rule recently passed and not brought to the attention of the electrical public had not been followed. Both parties should work together, for they are both using their best endeavors for the same end, *i. e.* to prevent the destruction of property by fire.

The Acushnet horse railroad, of New Bedford, have made contracts to have their road equipped within sixty days for the substitution of electricity in place of horses, as a motive power.

The Keegan Electric Motor solves the problem of small powers for domestic and mechanical uses. It is simple, compact and self-contained. Its operation is easily understood, and the liability to get out of order is reduced to a minimum. This motor excels in the economy of consumption of battery materials. About two amperes, a small current, is required to run it. The electromotive force required for the B motor is from 10 to 25 volts, according to the power developed. The Keegan motor, taking advantage of the fact that a battery will last longest on an external circuit of high resistance, is wound with fine wire of high resistance. The form of the pole pieces is novel; instead of attraction and repulsion, the forces act together to move the armature, which practically has no dead center. The current is broken only two times each revolution, and the commutator and brushes have contact surfaces of platinum. For the outer cell of the batteries used by the inventor, chromic acid is sold by Wm. J. Keenan, 73 Cornhill, Boston, where the motors may be seen in operation.

BOSTON, March 17.

A NEW TELEGRAPH AND TELEPHONE COMPANY IN PENNSYLVANIA.

Notice has been published in many counties of the State of Pennsylvania, stating that an application will be made to the Governor on April 15 for a charter which it is believed is to cover an extensive scheme of operations. The name of the proposed corporation is the Baltimore and Ohio Telegraph Company of Pennsylvania. The applicants for the charter are Frank W. Griffin, Joseph R. Kenney, Jacob S. W. Phillips, David H. Bates, and Charles Selden, and the notice is signed by their solicitor in Philadelphia. The character and objects of the company are the constructing, maintaining, and leasing of lines of telegraph for the private use of individuals, firms, and corporations, municipal or otherwise; for general and messenger business, for police and fire alarm, and for the transaction of any business in which electricity over or through wires may be applied to any useful purpose. The last stated object covers the telephone and electric light, and it is understood that the new company will enter into a rivalry with all others in these as well as in the business of establishing telegraph lines. It is claimed that under a charter such as is to be applied for, the company may go into any town or city in the State and put up its poles, wires, and other machinery for lighting and other purposes, even in competition with incorporated local companies, and it is asserted that the practical carrying out of the scheme means a monopoly of the business of furnishing electricity for all the purposes to which it may be applied.

Telephonic News

*** It has been suggested that the telephone may be advantageously used to transmit messages between sufferers from infectious diseases and their friends.

*** A. K. Eaton, of 65 Henry street, Brooklyn, N. Y., has issued an illustrated catalogue of his instruments of electrical measurements and spectroscopic appliances.

*** The Rev. Wm. Taylor, of Niles' Mich., is the inventor of a new telephone which he patented last month. It is called the "Domestic Acoustic Telephone," is run without a battery, but has an alarm bell.

*** Bell telephone advanced from 152½ to 161 upon advices from Washington that it was rumored that Mr. Garland will resign, and that the suit against the Bell company by the Government will be withdrawn.—*Boston Post.*

*** H. L. Leach, general Southwestern agent of the Inter-State Telephone Company, of Chicago, is in Indianapolis, looking over the field. He claims that his company is giving satisfactory telephone service elsewhere, and that it can do so in Indiana at legal rates. Possibly the owners of the Bell patents will have something to say.

*** If telegraph messages are able to jump through the air from point to point, the unwary pedestrian is placed in a precarious position. What with slippery sidewalks, banana and orange peel, and the liability of getting knocked down by a telegraph message that is in a hurry to get somewhere, outdoor life will be a burden.

*** In speaking of the withdrawal of the Central Union Telephone Company from business, in the state of Indiana, the Indianapolis *Sentinel* says: "We have no other feeling than that of kindness toward the company, and bear cheerful testimony to the satisfactory way in which it has served our people in connection with the Exchange in this city."

*** Mr. Edison is now a married man, and electric candles, electric nursing bottles, electric safety pins, electric machines to get up and walk the baby in the middle of the night, electric devices for cutting teeth and scaring off whooping cough, croup and measles are among the possible inventions of the future to reduce the troubles, trials and petty annoyances now certain to occur in every well regulated family.—*Chicago Tribune.*

*** There is a bill before the committee on railroads, etc., of the Ohio Legislature, similar to the Indiana bill, which the telephone companies are in hopes will not be reported on favorably by the committee, although this decision in Indiana may influence them to some extent. The matter will be decided within the next ten days. The Legislatures of Kansas, Missouri, Minnesota, Arkansas and Texas do not meet until next year, and if this Ohio matter can be postponed one year, it can easily be demonstrated that the business cannot be run for the prices provided in the bill.

*** The iron conduit of the Sectional Underground Company, of Philadelphia, again exploded in Chicago, one day last week, as described in the following special to the N. Y. *Tribune:* "There was a terrific explosion of gas at Clark and Madison streets, at 1.30 P. M. to-day, and the hughe iron cover of a manhole went flying through the air twenty-five feet away. The streets were full of teams and street cars, and the side-walks in all directions were crowded, and every one was badly startled. The explosion came from the underground conduit of the telegraph and telephone lines, and had been caused by escaping gas, but in just what manner is not yet ascertained. Nobody was hurt."

*** Captain J. F. Janes, who has just returned from a trip of twenty-three days at sea in his pilot boat, reports that the electric lights can be plainly seen from the summit of Santa Barbara Island, forty-five miles at sea, or over sixty miles from Los Angeles. The European ships standing up the Santa Barbara channel nearly every time mistake them for the lights of San Pedro, and stand in to Santa Monica, as the electric lights are not yet down on any chart. At that distance Captain Janes says that the lights appear as big as they do near the city. —*Los Angeles Express.*

*** The Central Union Telephone Company has issued legal notice to 474 subscribers in Indianapolis, 26 at Lafayette and 54 at Terre Haute, that their contracts will be terminated March 31 and their telephone service discontinued. The contracts of the remaining subscribers in Indianapolis and other cities can not be terminated until June 30, as they did not sign the contracts providing that fifteen days' notice was sufficient. Forty-one toll stations in Indiana have also been discontinued. The published statement that the company might possibly continue their private lines of subscribers has caused many applications to be made for private lines by subscribers who now realize that they can not get along without telephone service

*** The telephone is made the means of disturbing the equanimity of a Kansas paper, judging from the following in the Leavenworth *Times:* "Manager Luthur, of the telephone exchange, informs the *Times* that some disreputable parties are nightly calling up respectable people at their houses and using indecent, vile and vulgar language, and when asked where they are reply 'at the *Times* office.' The parties that use the telephone are not patrons of the company and contribute nothing to its support, The manager, Mr. Luther, has located the place from which the call emanates and will, if the acts spoken of are not discontinued, report the names to the authorities and have them prosecuted to the full extent of the law, it being a criminal offense to send such vile language over the wires. A word to the wise is sufficient."

*** Professor Page made a trial trip with his electro-magnetic locomotive on Tuesday, April 29, 1851, starting from Washington. The progress of the locomotive was at first so slow that a boy was enabled to keep pace with it for several hundred feet. But the speed was soon increased, and Bladensburg, a distance of, I believe, about five miles and a quarter, was reached in thirty-nine minutes. When within two miles of that place, the power of the battery being fully up, the locomotive began to run, on nearly a level plane, at the rate of nineteen miles an hour, or seven miles faster than the greatest speed heretofore attained. This velocity was continued for a mile, when one of the cells cracked entirely open, which caused the acids to intermix, and as a consequence, the propelling power was partially weakened. Two of the other cells subsequently met with a similar disaster. The professor proceeded cautiously, fearing obstructions on the way, such as the coming of cars in the opposite direction, and cattle on the road. Seven halts were made, occupying in all forty minutes. But, notwithstanding these hindrances and delays, the trip to and from Bladensburg was accomplished in one minute less than two hours. The cells were made of light earthenware, for the purpose of experiment merely, without reference to durability. This part of the apparatus could therefore easily be guarded against mishap. The great point established was, that a locomotive on the principle of Professor Page, could be made to travel nineteen miles an hour. But it was found on subsequent trials that the least jolt, such as that caused by the end of a rail a little above the level, threw the batteries out of working order, and the result was a halt. This defect could not be overcome, and Professor Page reluctantly abandoned his discovery.—*Ben. Perley Poore, in the Boston Budget.*

How the Messenger Business is Conducted in San Francisco.

In a recent issue of the *Alta California*, of San Francisco, appears an interesting account of the past methods of the rival companies engaged in the messenger service in that city: The little blue cloth-bound, brass-buttoned messengers that flit about the city at larger or smaller rates of speed, according to the prospects of a tip or their desire to play "crusoe," are the stock in trade of two pretty heavy corporations, and if the spirit of rivalry between the two companies infected the boys, the chances are that their bills for shoe leather would be larger than their salaries. Four years ago, when the San Francisco District Telegraph Company was organized, in opposition to the American District Company, the prices of service were mutual, the rate being fifteen cents per half hour, thirty cents per hour, and an additional five cents for every odd ten minutes over either space of time. Both companies flourished at these charges, the American paying steady dividends, while the San Francisco rapidly repaid the stockholders their investment in the plant, and in due time would have commenced the payment of dividends but for the war of rates that ensued after two years' hot competition at the old prices. After exhausting the business that could be brought in by agents, the American District Company, in December, 1883, made the war active by reducing the price of service to ten cents per half hour. The San Francisco Company, to make a stand-off on the bid for patronage and at the same time keep up rates to the public, adopted a rebate system which appealed to the cupidity of the proprietors of lodging-houses, saloons and other public places where a considerable demand for service existed. This rebate took the form of a present of five cents to the proprietor every time one of the San Francisco Company's boxes was turned in from the house, the condition being that the box of no other company should be maintained. Then the war descended from temperate to hot, and the bonus system came in, each company paying heavy prices for the exclusive privilege of maintaining its call boxes in good localities. These prices ranged from $20 to $200 per year, the lodging-house keepers growing more and more rapacious in their demands as they appreciated the desire of each company to freeze the other out and secure a monopoly. The cutting finally reached so low a point that in addition to the bonuses the rebate was also paid, and special rates, barely covering the cost of service, were made with many patrons. To show the extent of the business and the activity of the warfare, it is only necessary to state that between February and August last each company expended between $7,000 and $8,000 in bonuses alone. The San Francisco Company just about paid expenses, but made nothing. The American District messenger service is only a branch of the Gold and Stock Company's business, which also controls the greater portion of the stock in the Bell Telephone business here. The messenger branch, since the war began, has not been profitable, but having the two other branches of the business to draw on, dividends were constantly kept up until the last one fell due, and it, too, would probably have been paid but for the secretary levanting with several thousand dollars, all of which proved a total loss. In August last the heads of the two institutions met in friendly converse, one day, and began a comparison of notes.

The result was that they found that neither company had gained anything in the way of business, and that the subscribers of both remained about the same as when the war began. Their conclusion was that neither had made anything by it, and that all the profits had gone into the pockets of the generous public. Both managers concluded that the system was conducive of habits of slothfulness on the part of the public, which could more easily afford to hire messengers during war times than pay car fare or wear out shoeleather in transacting its business personally. A pipe of peace was therefore smoked, and a talk held concerning a cessation of hostilities. Many contracts with lodging-houses were about expiring, and inquiries developed the fact that the rise in prices would call for an outlay of about $15,000 from each side if the companies maintained their prestige and call boxes. The negotiations continued to progress, and the first of next month was selected for joining hands and ceasing the war. This date was selected because it pretty thoroughly exhausts all the contracts now in existence. The arrangement was concluded yesterday afternoon, and after the 1st prox. the rival corporations will be as amicable as cooing doves in the spring time. An agreement was drawn up and signed yesterday at 1 P. M., and the notices to customers will be out to-day. According to the terms of the agreement no more will the landlady be able to pay a month's rent with her bonus, nor the proprietor of the big saloon buy a barrel of whisky with the rent he receives for storage of the little piece of clockwork with a long wire attached. The agreement is castiron in its provisions, and provides for a forfeiture of $1,000 for each violation of any of its provisions by either company. The securing of patronage is to be left to legitimate methods and popular favor, and the old rates of fifteen cents per half hour and thirty cents per hour are made universal by both companies. No rebates are to be paid, no bonuses, either, and neither company can substitute its boxes for those of the other. If a citizen waxes wroth at his box and tears it out, he will have to do without, as the other company is bound by the terms of the agreement not to put another in its place. The signers of the agreement are Frank Jaynes, President of the American District, and Henry G. Phillips, Superintendent; and for the San Francisco Company, President Charles L. Ackerman, and Superintendent J. B. Gill. Both companies feel good over the settlement, but neither has any reason to exult in a victory, as the war was equally disastrous to both.

Since it has become known that the differences of the rival concerns were to be amicably adjusted, the stock of both companies has increased very materially.

Barrett's Strong Current Protector.

The cuts on page seven represent the strong current protector and lightning arrester of Mr. Jno. A. Barrett, of New York. The cuts illustrate the principle upon which the protector operates. A spring switch is combined with a fuse wire and ground plate in such a way that when the fuse wire gives way, under an unsafe current, the switch carries the line directly to ground. By this means dangerous arcs and extra currents and flashes, which otherwise are produced at the point of opening the line under strong currents, are prevented, and the line is better protected throughout its entire length by being entirely relieved of its high tension of electricity, through a good ground connection. As shown in Fig. 1, a fine insulated fuse wire passes from the line connector around the ground pin, or rod, to the instrument or cable. A spring from the line connector is hooked down under the fuse wire. This fuse wire is gauged to conduct all safe currents. When a current which would be harmful to the instrument or cable, comes in on the line, the fuse wire gives way and the spring snaps instantly to the ground.

Fig. 2 shows the instrument disconnected, and the line connected to ground through the switch. The fuse wire used is insulated German silver, of small gauge. This has great tensile strength, together with the required heating and fusible qualities.

The New York and New Jersey Telephone Company have made extensive use of the arresters, and are so well pleased with them that they have adopted them for all their important lines. They are inexpensive and reliable, and are well worth consideration by the telephone interests in general.

Messrs. Lytle & Co., 15 Cortlandt street, will handle the invention.

—— Burlington, Iowa, expects to have its electric light plant in operation by the 1st of next month.

History of the Progress of Electric Lighting.

By John W. Beane,
Before the National Electric Light Association.

Mr. President and Gentlemen:

In view of the rapid growth of electric lighting and its wide spread and varied applications at the present time; an adequate treatment of the interesting subject of this paper within a limit proper to the occasion is not only difficult but well-nigh impossible.

The progress made in the field of commercial electric lighting has been remarkable—indeed it has been wonderful. When it is considered that but ten years ago the electric light had just reached the dawn of its commercial career, whilst to-day there is not a civilized country on the face of the globe but feels the glory of its rays—that from functioning as a mere scientific curiosity it has at length become a most important and beneficent factor in so many of the operations of daily life, we cannot but wonder at the magnitude of the work performed, and render praise, so well earned, so justly due—to the instruments of its accomplishment.

Whilst we must go back as far as the year 1802 for the first exhibition of the electric arc between poles of carbon, to Sir Humphrey Davy is due the honor of the discovery. Not until 1836 was any substantial headway made towards the solution of the problem of practical electric lighting; fresh impetus was then given the subject by the advent of the Grove voltaic battery, and for the first time the production of the electric light on a practical scale became possible. In the same year it was installed for theatrical purposes at the Opera House in Paris.

The many superior qualities of the electric light were early appreciated, yet its employment was limited; principally owing to its high cost and the crude methods of its production. Among the noteworthy cases of its early use it may be interesting to recall the installation at the building of the Cherbourg Docks in 1858, whereby work was continued at night as well as during the day time, and 1,800 men were constantly employed. Notwithstanding the fact that Faraday discovered the principles of electro-magnetic induction as early as 1831, thirteen years elapsed before a machine for electric lighting on a large scale was produced. Stohrer of Leipzig was its constructor; nor was it until about the year 1862 that the first successful permanent plants were installed—they being used in lighthouses on the French coast. The most romantic portion of its early career, perhaps, was its service during the Siege of Paris in 1870 and 1871, when the French employed it for watching the movements of the enemy.

The year 1879 seems a natural dividing line between the early and recent history of electric lighting. Prior to this year Pixii had made the first application of Faraday's discovery. Siemens had invented his well-known form of armature, the principle of mutual accumulation had been discovered and applied; Pacinotti had exhibited his ring armature; Gramme had brought out his perfected form of the same idea; Nollet had connected the "Alliance" machine; and in America Wallace-Farmer had their machines on the market, and Brush had obtained a foothold with his system of arc lighting. At the close of 1879 Sawyer-Man and Edison had perfected their incandescent carbon lamps. In Europe, Paris led the way, and at the close of 1878 some 300 arc lights were in use in the boulevards, gardens and public buildings of that city; the Jablochkoff candle then held full sway, and it was shortly adopted to light the Thames embankment in London. At the beginning of the year 1880 we find a few lighthouses on the French and English coasts and a small portion of the streets of New York, Philadelphia, London and Paris lighted by electricity. The infant, however, had become of sufficient size to suggest the giant it has since become, and opposition began to rear its head, and from that day to this its struggle for recognition has been as severe as phenomenal.

It is interesting to look back upon the vast multitude of dynamo and magneto-electric machines which have been evolved during the past fifteen years, and to note that to-day the number of types in actual use for lighting can almost be counted upon one's fingers.

The great advance has been made in the direction of the perfecting of details, and whilst in 1880 there was hardly a generator but wasted a considerable percentage of energy in the heating of its armature and useless friction, and gave pyrotechnical exhibitions of an extraordinary character at its brushes—a commercial efficiency of 84 per cent. being considered phenomenal—to-day we have machines that run continuously for months with no other attention than their lubrication and the replacement of brushes, no sparking, no heating, and in which an efficiency of over 88 per cent. is easily attained. In the Paris system of 1878 alternating current machines were used, with small continuous current magnetos to excite the field magnets. A sixteen lighter was the largest machine employed, whereas to-day the forty-five lighter is the average machine and sixty-five lighters are quite extensively in use.

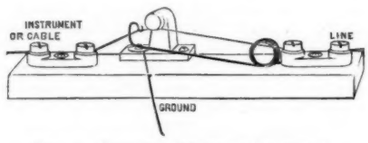

Fig. 1.—Barrett Lighting Arrester.

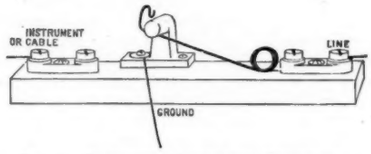

Fig. 2.—Barrett's Arrester, Grounded.

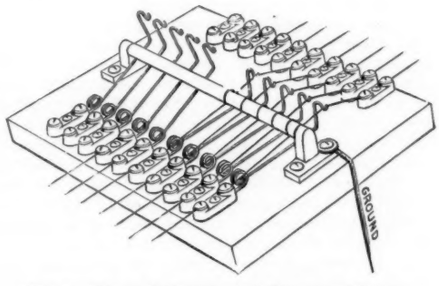

Fig. 3.—Showing Barrett's Arrester in Series.

What has already been said of the prolific invention of electric generators applies with double force to the case of electric lamps. There has been, we may say, a perfect downpour of this character of invention; in fact, it would seem as if every inventive or otherwise genius since the time of Dubosq had at one time or another tried his hand at the conception of a new arc regulator. The field has at length so narrowed down that we find lamps operating on the clutch principle and regulated by means of an electro-magnet placed in a shunt spanning the arc in almost universal use. Next to the lamp in importance comes the carbon, and, in no small measure, is the successful application of the voltaic arc to practical lighting due to Foucault's suggestion of the use of pencils of gas retort carbon; this improvement has been followed by others, one after another, so that at the present time the manufacture of carbons has reached a high state of chemical and mechanical accuracy. Instead of gas retort carbon, a somewhat similar but purer form of carbon—petroleum coke—is now most largely employed, combined with other materials; and the light from a given current has been more than doubled by the improvements in the character of the pencils used since gas retort carbon was first introduced.

The early history of the incandescent lamps dates back to 1838, when Prof. Tobard, of Brussels, proposed the commercial application of the fact that a carbon filament in vacuo, under the action of a passing current of electricity, became incandescent, emitting an intense fixed light; but its commercial career began in the latter part of 1879, when Edison patented his glow lamp. From that day to this its general form has not been changed much, but in point of efficiency and life remarkable improvement has been made. At the Paris Exhibition of 1881 the best average number of standard candles per electrical horse-power obtainable was 196, and 400 hours was considered a good average life in actual practice, whilst recent tests show 210 candles per horse power, and the average life is 900 hours. (These figures are in each case given for operation under favorable conditions.) We are, therefore, able to obtain about a lamp more from a horse-power, and have doubled the life. These improvements are due quite as much to a better knowledge of their care and manipulation as to better modes of manufacture. In point of cost, lamps that cost $5 at the time of the Paris Exhibition of 1881 can now be bought for less than $1.

Since the early days of electric lighting the play-house has proved its steadfast patron, and the Paris Opera House may very appropriately be called its godmother. The progress made in this branch of lighting has been very satisfactory; it is rapidly growing in the number of plants installed and in favor, and it is not too much to say that the outlook for its exclusive adoption for theatrical lighting is extremely bright. There are now many fine installations of this character at home and abroad. Among the most noteworthy of these are the Opera House, in Paris; the Prince's Theater, the Savoy, Criterion, in London; the Prince's Theater, in Manchester; the Prince of Wales and Royal Theaters, in Birmingham; two theaters in Glasgow; the Court and Palace Theaters, in Munich; the Court and Town Theaters, at Brunn; and a number in Berlin, Vienna and Stuttgart, and other large cities on the continent. The largest installation in the world is that at the Theater Della Scala, in Milan, which is lighted by 2,862 glow lamps. In this country there are in all some thirty theaters lighted entirely or in part by electricity; as, for instance, McVicker's Theater and the Chicago Opera House, in Chicago; the Milwaukee Opera House; the Metropolitan Opera House, where it is used for stage effect; the Third Avenue Theater, Lyceum Theater and Miner's Theater, in New York, and others of less note in different parts of the country. McVicker's has probably the largest plant of this kind, lighting 1,200 incandescent lamps in all, whilst for artistic designs and novel effects the installation of the Third Avenue Theater ranks second to none.

The incandescent system has to a large extent monopolized this field, owing, among other things, to its ease of manipulation; although a plant was recently installed in Paris, where the arc lamp is used in connection with a certain novel arrangement for increasing or decreasing the amount of light allowed to escape from the lantern in which it is placed.

It its hardly within the province of this subject to detail the advantages gained by the use of electricity for theatrical lighting—indeed it is not necessary; they are too obvious; suffice it to say that there is every reason for its adoption, not only in point of safety, health and comfort, but also for economy's sake, since in installations of say 200 lights and over its cost is now less than that of gas.

The advance made in central station lighting is worthy of special note, for in this we have a reliable indication of the popularity to which lighting by electricity has attained. All of the principal cities in the United States have one after another adopted central station lighting, and ours stands to-day the most brilliantly lighted country in the world.

New York City, first in the field in this country, maintains the lead, and there are not less than 5,000 arc-lights in operation nightly in her streets, buildings and public places. Boston and Chicago follow with about 2,000 less, whilst Philadelphia lights upwards of 2,000. Central station lighting by the incandescent system has grown very rapidly since '82, when it was introduced, and at the present time there are over fifty towns and cities lighted in part or entirely in this way, "burning" upward of 100,000 lamps daily. Tower lighting has scored some success in the West, and boasts a number of towns and cities where it is exclusively used, as, for instance, Detroit, Peoria, Elgin, San Jose, Los Angeles, Pekin and Decatur.

Abroad we find quite a number of examples of central station lighting, although there are none that reach the capacity of our own large plants. Among the more important ones may be mentioned those of the Holborn Viaduct, Brixton, Victoria Station, Godalming, Chesterfield, Colchester, Greenock, Glasgow, Edgeware Road Station of the Metropolitan Railway in Great Britain; in France those of St. Etienne, Tours, Haute Savoire, Roche-Sur-Foron; in Berlin on Markgrafen strasse; Temesvar, Austria; Hanover, Germany, lighting a portion of the streets by glow lamps. Paris lighting the Jardin de Plantes and the Champs Elysees; Geneva, Switzerland and others scattered on the continent. The only town in Europe lighted entirely by electric light is Temesvar, Austria.

Central station lighting is growing in Europe, and while not in the same proportion as in this country, it is a good healthy increase, conservative and sure, and indicative of the firm hold the light now has upon popular favor in that part of the world.

Isolated lighting, in the field of arc-lighting, amounts in this country to only about one fourth of the entire number of lamps installed, whereas in Europe isolated lighting is the rule rather than the exception, both in arc and incandescent lighting. In this country there are nearly twice as many lamps installed in isolated plants as in central station systems. The reason for this is owing to the fact that about 60 per cent. of the lamps operated are installed in manufactories, mills, refineries, and miscellaneous manufacturing establishments, where the facilities for the use of local power are great. It would be an almost endless task to mention even a tithe of the vast multitude of notable private or isolated installations which abound in this country, there being some 23,000 arc and 165,000 incandescent lamps in operation daily.

The greatest increase is to be found in installation for banks, office buildings, and

stores, whilst the number of plants now finding place in hotels, newspapers, and printing offices is noteworthy; there are not less than fifty newspaper and printing offices; of New York, the *Herald*, the *World*, *Tribune*, *Sun;* Boston *Herald*, and Detroit *Free Press.*

The Palmer House in Chicago, Murray Hill Hotel, Hotel Dam, the Union Square Hotel, and Gilsey House, in New York, are perhaps the best known hotel plants, although there are quite 20,000 lamps, arc and incandescent, employed to light the hotels, club rooms, etc., in this country.

In Europe the number of isolated plants is rapidly growing from day to day, and several of the famous American electric light companies have done much to push the good work along. The London Stock Exchange, the *Irish Times*, *Daily Telegraph*, and London *Times* buildings are lighted by electricity, also the new London Law Courts, the House of Commons; the Colonial Parliament Houses in Cape Town and New South Wales; at Malvern, England; the Municipal Hospital, in Havre; the Female Hospital, in Berlin; the Bauer Cafe, in Frankfort-on-the-Main; the University of Paris, the Hippodrome, the Magasins du Louvre, the Magasins du Gagne-Petit, the Hotel Continental, the Opera, the Eden Theatre, the Grand Hotel, the Magasins du Printemps; the Cafe de la Paix, the Lycee Louis le Grand, in Paris; the railway station at San Pierdarena, Italy, Vazallo, Italy; the Central Railway station at Budapest, Hungary. In Munich there are about 4,000 incandescent and 200 arc lights. Isolated plants are established in Berlin, Hamburg, Dresden, Hanover, Bremen, Cologne, Leipzig, Breslau, Chemnitz, Crefeld, Bannen, Ebberfild, and a large number of smaller German towns. In all there are not less than 2,000 arc and 25,000 incandescent lamps installed throughout Germany, exclusive of those in isolated establishments not connected with gas systems, and we may state that this estimate, therefore, falls far short of the entire number installed. We also find isolated plants of incandescent lamps in many smaller towns in England, as Norwich, Plymouth, Nottingham, Harrogate, New Cross; and in France, as at Armentieres, Tourcoing, Avenes; Turin and Palermo, in Italy, are partly lighted by electricity; Ghent, in Belgium, and Barcelona, in Spain.

Domestic lighting, that is the lighting of private residences, has not flourished here in equal proportion as lighting for business purposes, owing to a disinclination to assume the increased expense; there are many more installations for private lighting abroad than in this country. It may be mentioned in this connection that a number of art and picture galleries and libraries have been lighted by the electric light, among which are the Boston Art Club, Columbia College Library, the Central Hall and Corporation Galleries, of Glasgow, the Brighton Art Exhibition, and others.

The accumulator plays its part in many of these private installations, whilst its use is extending rapidly, owing to marked improvements during the past year or so in the general efficiency due probably to our more extended experience in their care and management. They are used economically, it is stated, in large plants at Cheyenne in this country and in Colchester, England. Lighting by the primary battery has not so far made very great headway, owing to its two great drawbacks, polarization and expense.

The lighting of railway carriages by electricity has now been a matter of experiment in England for two years past, and has proved a perfect success, it having been found cheaper and more effective than any other method of illumination. The first notable instance of lighting of this kind was on the coaches of the London and Brighton Railway, where two trains are now constantly running with plants consisting of accumulators which are charged by a dynamo connected with the axle of the guard's van.

Experiments have also been conducted, and trains are now running lighted in this way on London and Northwestern, South London, the Great Northern, Lancashire and Yorkshire, and Great Eastern Railways in England, and the Frankfort Fulda and Ulm Line, in Germany.

Our own Pennsylvania Railroad now runs an experimental train between Altoona and Pittsburgh, using accumulators, and the light is said to be very satisfactory.

The great value of a powerful light, such as the electric light, for railway purposes was early recognized, and experiments were begun about 1875 to adopt it to use in headlights for locomotives. There has been considerable progress made in this field during the past few years, notwithstanding the absurd objection to their general adoption that they cause an obscuration of the colored signal lights. If this were in any measure true, it is a difficulty that could be easily overcome—the advantages of a light which will illuminate a track as light as day for a distance ahead of over a half mile, so far that an express train traveling at night at top speed could be stopped in time to avert disaster in so many cases, which with our present mode of lighting would be impossible; this is an advantage not lightly to be thrown aside, and the time is not far distant when public opinion will force our railways to its adoption.

This light is in use in Russia, and in this country it is installed on several roads running into Cincinnati and Indianapolis, is being used experimentally on suburban trains of the Illinois Central at Chicago, and also on the Lehigh Valley Railroad.

Perhaps in no place has the electric light proved more welcome than on board ship, and here its superior qualities appear all the more striking; the stowing of inflammable oils is avoided, the air of the saloons and cabins is greatly improved in point of purity and temperature, and, above all, the danger of fire at sea is lessened in a great degree.

Since then this branch of lighting has grown slowly with very bright prospects for the future. To-day there are many fine ship plants in operation in this country on our bays and sounds of the East, and lakes and rivers of the West. Especially interesting are those of the palatial sound steamers, plying on the Boston routes through Long Island Sound, their saloons, staterooms, steerages, holds, engine rooms, etc., lighted by a total of from 400 to 500 incandescent lamps. Quite a number of our men-of-war are now illuminated in this way, and the plans for all the new ones in course of construction call for electric light installations. Of the steamships plying between American and European ports thirty-three are supplied with electric light plants. In England more attention has been paid to this matter than in this country, and although it has only been three years since the first application of incandescent electric lighting to the general illumination of steamships, yet more than one hundred and seventy-five ships have been lighted in this way, and now scarcely a man-of war, or a first-class passenger steamer leaves the builders' hands but is fitted with the electric light.

It is used on board of steamers of the Peninsular and Oriental Steam Navigation Company. Thirty-two steamers on the Seine are lighted by the incandescent system. Such powers as France, England, Germany, Italy and Austria have adopted it for the illumination of their war and other ships. So with Chili and Brazil, and many of the ships fitted with electric light plants also carry powerful arc search lights (about 15,000 candle-power) for lookout purposes. Quite a number of yachts have added the luxury of an incandescent plant.

The electric light has been in use in lighthouses since 1863 when it was first installed at the French first order lighthouse of La Heve, near Havre, and one and a-half years later it was applied at the other lighthouse of La Heve, the "Alliance" magneto electric machine and Serrin lamp being used. The light has been since adopted for several other lighthouses in France, at the South Foreland and Cape Lizard in England, Odessa, Russia, Port Said, Egypt, the light house on the Island of Raza, in the Bay of Rio Janeiro, at Hell Gate, Long Island Sound, and a few other places.

Although the great value of the electric light for coast lighting purposes was so early recognized, yet its advance has been far from rapid in this field. Recently, however, active interest in the subject has revived with the improvements in the means of producing the light and our more extended experience in its management, and for sometime past exhaustive experiments have been in progress at the South Foreland lighthouses to determine the status of the electric light as compared with oil and gas for lighthouse purposes. The committee appointed by the corporation of the Trinity House which conducted these experiments, have reached the conclusion and report that "for the ordinary necessities of lighthouse illumination, oil is the most suitable and economical illuminant and for salient headlands, important landfalls, and places where a very powerful light is required, electricity offers the greatest advantages."

In this country experiments are being conducted by our Government at the Experimental Lighthouse Station at Tomkinsville, Staten Island, with very satisfactory results. The incandescent lamp of high candle-power possesses certain qualities which promises to render it of use as a lighthouse illuminant and considerable experimental work is being done in this direction.

Mine lighting by electricity has been an accomplished fact for some years past, and we now find it installed in mines of all characters. At the Fresuais Quarry, at Angers, France, we have probably the first instance of mine lighting by the electric light, the plant having been installed in August of 1878. Since then several mines have adopted it in this country. A number of the English, French, German and Belgian mines and collieries are lighted in this way. Its use is extended in this direction, and very naturally so since it is so perfectly adapted to this character of work.

In the lighting of mills, factories, workshops, refineries; in short, establishments of a purely industrial character we have at present the most flourishing branch of electric lighting. The first plants of any considerable size in this country were thus installed, and abroad, say in France and Germany, outside of the large cities the use of the electric light is confined principally to the illumination of mills of all descriptions and manufacturing establishments.

The introduction of electric illumination into mills has been followed in all instances by most gratifying results, both in regard to the quality of fine figured or colored goods, and the health of the operatives. In New England mills not lighted by electricity are decidedly the exceptions, and it is safe to estimate at present at least 90,000 incandescent and 6,000 arc lamps in use in the United States for lighting mills, factories and miscellaneous manufacturing establishments.

These, gentlemen, are, perhaps, the principal application of the electric light in everyday use, but there are other special cases too numerous to mention; for instance, in Algiers, where the temperature is so high for the greater part of the day that harvesting by Europeans is utterly impossible, the work is conveniently done at night by aid of the arc light. In the war between the English and the Mahdi in Egypt, a portion of a railway was built by portable arc lamps. Work on the bridge across the Forth, in Scotland, is prosecuted at night by means of an arc-light installation. Submarine boats have recently been lit by incandescent lamps and so on, *ad infinitum.*

In the United States and Canada the electric light finds its widest applications, and in the States there are upwards of 95,000 arc and nearly 250,000 incandescent lamps distributed in over 400 cities and towns.

Canada is a little behind this in proportion to her population. Guatemala has probably the largest installation of any city in South America, burning 300 arc lights; Valparaiso boasts 200 arc and the city of Santiago 2,000 incandescent lamps. The cities of Mexico, Buenos Ayres and La Plata are each lighted by the electric light. There is hardly a nation on the Western Continent but boasts the electric light within its boundaries. So with Europe, Asia, Australia and even Oceanica. In Australasia, according to a recent report, there are 400 arc and 5,000 incandescent lamps in daily operation. In Europe there is but one country in which the electric light may not faithfully be said to flourish, and that is in Portugal; the largest installation throughout the length and breadth of the kingdom consists of a dynamo and a solitary arc lamp, which is used at the ancient Tower of Belem, on the Tagus. In Germany, during the last six years, 6,000 dynamos and 20,000 arc lamps have been manufactured. In France the most popular light is that of the glow lamp, of which there is a large and daily-increasing number installed. Water-power is largely used in the interior for the generation of the electricity. Austria, Belgium, Italy, Switzerland and Russia all possess installations of more or less importance.

England, whilst unfortunate in the possession of an unreasonable "Electric Lighting Act" passed in 1882, which in a great measure bars the application of capital to this enterprise, owing to the elements of uncertainty which it introduces, still has made very commendable progress; and, as there is a probability of the repeal or modification of this law in the near future, the prospects of much more extended operations in that country are very bright.

Experiments have been under way for some time past at the Suez Canal, and it is announced that to accommodate the great increase in the traffic it will shortly be lighted throughout its entire length by electricity, so that ships may pass at night as well as in the day-time.

China and Japan boast a number of plants, and, as a proof of the enterprising tendency of the electric light, we may recall the fact that the palace of the Ameer of Afghanistan is lighted by electricity.

In the United States, however, the electric light has advanced with greater strides than in any other country in the world. Only thirteen years ago Prof. Tyndall exhibited at Horticultural Hall, in Philadelphia, probably the first arc lamp seen in public in the United States (it was a poor specimen of the arc lamp as we now know it); and at the present writing there are not less than $70,000,000 invested in the business of electric lighting in this country alone; at least 25,000 incandescent and 12,000 arc lamps are newly installed each year. Over six tons of mercury and 700 air pumps are in use for the manufacture of glow lamps. In Paris, in 1878, the cost to the city was at the rate of 29 cents per hour for a lamp of from 500 to 700 candle-power. To-day, under like general conditions, the city of New York pays at the rate of about six cents per hour for a lamp of 2,000 candle-power. There are 30,000 carbons manufactured for arc lamps in the United States daily, one of our large firms consuming 25 tons of petroleum coke per week.

To those who have watched the progress of electric lighting, this bright survey of the present state of the art cannot but also recall the dark days of 1881, when, surrounded by distrust and suspicion, following a season of wild speculation, the outlook was gloomy indeed, especially so in Europe. Who but the most sanguine could there have predicted what we see to-day.

The future prospects of electric lighting are, indeed flattering; and, when we consider that of all commercial enterprises the capital invested in illumination is second only to that employed in transportation, the vast possibilities before us may be realized. Gentlemen, we have seen the budding and will soon behold the flower.

*** Superintendent Easterlin of Charleston, S. C., and Superintendent McClure, of Richmond, Va., both capable officers of the Southern Bell Telephone Company, were in New York last week. These gentlemen have been very successful in handling the numerous intricate questions that come up in the telephone business, and are increasing the business quite generally throughout their territory.

Underground Wires.

Nobody will deny that the aerial telegraph, telephone and electric light wires are an unmitigated nuisance, often a serious obstruction in case of fire, of en an obstruction to light, and always unsightly and ugly. Acting on this state of things, many of the larger cities of the country have peremptorily, through their local governments, ordered the wires under ground.

The recent convention of electric lighting companies to Baltimore threw some interesting light on this subject, and unfortunately it did not favorably shine on the practicability of the underground system, at least so far as electric lighting is concerned.

It was shown that in New York over 100 different ways of burying wires had been tried; most of them had failed utterly, and but few are in use, and these are indifferently successful. In Chicago, arc-lights are run by underground wires, but at a cost too great to make the system commercially successful. Philadelphia's experience is similar to Chicago's. Since last November, the Brush plant in Philadelphia has put three systems in operation, and all have been unsatisfactory, and have ceased to operate.

Of course, it *can* be done, as oranges can be grown in Maine, but thus far it would seem that no plan, with economy enough in it to make it practicable, has yet been devised Some representatives at the convention even went so far as to say that were their companies required by law to put their wires under ground, using the best known system, they would be obliged to shut down altogether, because they could not do it and furnish light at a profit at current rates.

To cap all previous objections to the underground system, Mr. C. J. H. Woodbury, of Boston, in his paper touching on insurance, took the ground that grave elements of danger attached to every known system of burying electric wires.

All this puts a new phase on this subject, and in view of the testimony of men who are, doubtless, as anxious as the average board of city fathers to get rid of overhead wires, and who, of course, are vastly more familiar with the subject than said board, it may be well for those in authority to look at both sides of the matter, and not be too hasty in ordering wires out of sight. Overhead wires are certainly not so much of a nuisance as the loss of the electric light would be a calamity.—*Boston Commercial Bulletin, March* 13.

Western Union Telegraph Company.

The directors of the Western Union Telegraph Company, at the regular quarterly dividend meeting on Wednesday, ordered an issue on April 15 of certificates of indebtedness, payable in the capital stock of the company at par, within twelve months, or when the company shall have obtained authority to increase its capital stock; and until so paid the certificates bear interest at the same rate, and payable at the same time and in the same manner as the company shall pay dividends on the capital stock. The certificates are transferable on the books of the company at the rate of 1½ per cent. on the present capital stock, to stockholders of record on March 20, in lieu of a cash dividend for the current quarter ending March 31. The estimated returns for the quarter show a net sum applicable to the payments of dividends of only $906,509. As 1½ per cent. on the capital stock is equal to $1,200,000, the company is to issue certificates of indebtedness to the amount of $293,491. or about ¼ per cent. in excess of the estimated net earnings for the quarter. The estimated results for the current quarter, compared with the actual for the same quarter of 1885, are as follows:

Quarter ending March 31.	*Actual.* 1885.	*Estimated.* 1886.
Net revenue	$1,358,876	$1,050,000
Deduct interest and sinking fund	143,750	143,491
Net income	$1,215,117	906,509
Less dividend	1,199,841	
Surplus for quarter	$15,276	$906,509
Add surplus for Dec. 31, 1885	4,231,667	4,102,180
Surplus for March 31, 1886	$4,246,943	$5,008,689

The corrected statement for the quarter ended December 31, 1885, shows the actual net for that quarter to have been $235,441 less than the estimates, and $401,288 less than for the same quarter of 1884.

The corrected figures for the six months ending December 31, 1885, make the following showing:

Net revenue	$2,965,128
Interest on bonds and sinking fund	287,232
Balance	$1,977,896
Dividends paid, 2¾ per cent.	2,199,721
Deficit for six months	$221,825
Add deficit for current quarter, as estimated after 1½ per cent. dividend	293,491
Deficit for nine months after payment of 4¼ per cent. dividend	$515,316

The statement just issued explains the decline in revenues as follows: "The falling off in the net revenues for the last quarter was in the cable, commercial news and quotation service. There was a large increase of expenses for taxes and cable and land line repairs, which are beyond control. The receipts for regular inland commercial messages have been well maintained, the weekly receipts therefor at test offices (which include those at all the principal business cities and towns and all the important points reached by competing lines) showing an increase of $31,176 over those of the corresponding quarter of the previous year." In the statement of December 9, 1885, the president said: "The estimates of net earnings for the past and present quarters have been materially reduced by the extraordinary expenses of cable repairs of both the Atlantic and Cuba cables, by large payments on account of litigated taxes, and for taxes in a number of States which are payable in the autumnal quarters, exceeding by about $400,000 the ordinary expenditures."

Why the Lights Went Out in St. Louis

Olive street from Sixth to Fourteenth street, St. Louis, which no later than a few nights since was beautifully illuminated by over a dozen electric lights, is now in comparative darkness. The cause of the sudden gloom on that once brilliant thoroughfare was explained as follows to a reporter, by a prominent Olive street business man, who had an electric light in front of his establishment for some time, and only after he had closed up for the day. "These lights," he said "were paid for in every case by business men who do not own the buildings in which they conduct their business. The illumination paid for by myself and others served to make Olive street a popular thoroughfare at night, but did not benefit those providing it to any extent. Now comes the real grievance When the owners of the property on the street saw the effect of the night illumination, they raised the rents, as a reward for our efforts to improve the property. When Mr. Franklin, of the William Barr & Co. firm, decided to discontinue furnishing the light, we were approached by others anxious to obtain the contract; but we took a sensible view of the matter and decided to leave the street in darkness, as a mark to the greed to the property owners. They will hardly find this a shining mark, however."

An intricate and interesting machine, which for over two years has stood in the room of one of the House committees at Washington, D. C., is to be removed. It has an interesting history. An old gentleman named Crosby, noticing with some degree of annoyance the immense amount of time lost in the calling of the yeas and nays, undertook to invent a machine which could record the vote almost instantaneously, by the means of electricity. There were to be electric buttons at each Congressman's desk. The pressure of one recorded yea and the the pressure of the other recorded nay upon a printed slip at the Clerk's desk, while at the same time an ingenious arrrangement moved the hands on the dial on the Speaker's desk and showed at a glance how many votes had been cast on each side. The inventor after having had an expensive model made, was taken sick and was compelled to spend nine months in Florida. The next session was a busy one, and he could get no one to listen to a dissertation on the merits of his invention. This year his son fell sick and died, and he has not been able to urge upon Congress the adoption of his machine. The Speaker will probably give orders to have the apparatus removed, for it fills up considerable space. Mr. Crosby wants $75,000 from the Government for his invention.

——The relative merits of gas and electricity for illuminating the city of Manchester, N. H., is now the chief topic in the council chamber. If the people of Manchester are wise, they will insist on electricity

——W. Sheehan, trimmer for the Newburgh Electric Light Company, received a severe fall, by the step ladder on which he was standing spreading apart. This is another case where gravity caused more injury than electricity.

—— The Central Union Telephone Company is talking of extending its Peoria line into Burlington. It is already built as far westward as Kirkwood. It would be quite an advantage to the subscribers to have it brought into the city.

—— The Thomson-Houston Company have secured a contract with the city authorities of Selma, Ala., to supply the city with thirty electric lights at $10 a month per light, and as many as sixty additional lights on the same terms, provided these lights, or any number of them, are contracted for within forty-five days after the first thirty are established.

—— The Boston Gaslight Company is still continuing, at a great expense, its disinterested efforts to save the public health from the impending perils of water gas. How the conscientious consumer's heart must smite him that he ever "kicked" against the bills of so benevolent a corporation, in the days before the approach of competition compelled a lowering of the rates.—*Boston Traveler.*

—— The stockholders of the Brush Electric Light Company, of Baltimore, met in that city on Saturday last. Mr. C. W. Slagle occupied the chair, while the president, Mr. J. Summerfield Baldwin, read the report of the officers and directors. The following board of directors was chosen: Messrs. J. Summerfield Baldwin, E. G. Miller, Dr. Wm. Whitridge, Henry E Reinhard, James P Shannon, George H. Baer. J. Frank Morrison, Samuel W. Regester and H. F. Deford.

—— A contract has been closed for the lighting of the Panhandle shops in Columbus, Ohio, and Dennison with the Brush electric light. Preparations for putting in the lights will begin immediately, and it is expected it will be about a month before they are in working order. One of the best of Armington & Sim's engines will be put in the shops, and one of the Brush dynamos will be used. The whole number of lights in the shops and yards will be about sixty. Two additional buildings—a boiler and a blacksmith's shop, will be erected on the Columbus grounds the coming summer.

—— In Pittsburgh a syndicate composed of T. H. Ortman, James Patterson, S. P. Connor, J. O'C. Campbell and other prominent business men of the South Side, has been formed for the purpose of lighting the dwelling houses and stores on that side of the river with the incandescent electric light. Arrangements have already been completed for placing some lights in dwellings and business houses at a cost not to exceed that of gas. Each room in which the light is placed will be provided with a button and a switch by which the lamps in that particular room only may be lighted or turned off. The company will commence operations in a few weeks.

—— The Tacoma, Washington Territory, *News* says the sound of the cars is plainly heard on the line of the Atlantic & Pacific Railroad, at the Needles, for a distance of 75 miles, to a place called Cottonwood Island. The discharge of the sunrise gun at Fort Mojave can be plainly heard at Colorado Canon, a distance of 100 miles. Sound can be understood in the narrows of the Grand Canon of the Colorado for a distance of 18 miles, or, in other words, if a man at one end shouts "Bob!" the man at the other end can plainly hear the echo. The whistle of a Colorado steamer can be heard from El Dorado Canon to Weaverville, the head of navigation, a distance of 78 miles, and by tumbling a rock over the precipice at Lee's Ferry you can plainly hear the echo down the river at Weaverville, a distance of 36 miles.

ELECTRIC LIGHT NEWS

—— The President of the Municipal Assembly, St. Louis, has signed the Electric Elevated Railroad bill.

—— The Reading, Pa, Electric Light Company is erecting a new station, which will require some 200,000 bricks in its construction.

—— The Sandusky Electric Light, Fuel Gas and Supply Company, of Sandusky, O., has just been organized by Watson Hubbard, Jay O. Moss and others.

—— At the meeting of the Faribault (Minn.) Common Council held last week, an ordinance relating to electric lights was passed and ordered published.

—— The Vitrite and Luminous Company, Watervliet, N. Y., has been organized with a capital stock of $400,000. Fred W. Roebling, 117 Liberty street, and others, incorporators.

—— The Arnoux Electric Light Company, of Wilmington, Del., are putting in the wires for their lamps at the works of the McCullough Iron Company. It is not to be an isolated plant, but is to be supplied from the company's station.

—— Mr. Henry G. Rees, of Philadelphia, has removed from 730 Sansom street to 23 and 25 South Fourth street. Mr. Rees is doing an excellent business in the electric lighting field, and was compelled to make the move to secure increased facilities.

—— The electric light company of Vicksburg, Va., appears to have gone earnestly to work, and a number of employes are at work locating private subscription electric lights on Washington street, both sides, and placing the wires in business places where the lights are to be used. The machinery of the plant is all ready for work, and as soon as the locations of the public lights are determined upon the electric fluid will be turned on. It is likely that before a great while the same thing may be said about the Natchez Electric Light Company.

—— President A. E. Powers, of the Troy Electric Light Company, appeared before the contracting board and stated that if the city wishes the 250 lights ordered by the common council it will be necessary for the contract to be let soon. The old contract with the company expires April 24. It has plenty of power to supply the light, but not the needed machinery, and it does not wish to order such machinery unless it is sure it is to get the contract. It is likely plans and specifications will be presented at the next meeting of the board.

—— It is likely that the Brooklyn electric lighting system will be doubled during the present year. The contracts for gas lighting for the current year have not yet been made, and when an electric lamp is put up at any point, a number of gas lamps in the vicinity are ordered capped, and about as much is saved in gas as is paid out for electricity to take its place. In this way about 3,000 gas lamps were extinguished last year and replaced by electricity; and Alderman McKane said that about the same number would be replaced by electricity this year, as the electric lighting companies enlarged their facilities.

—— A special from Wheeling, W. Va., says: Two electricians employed by the Baltimore & Ohio came here from Baltimore a a few days ago. They brought with them two telephones of German invention. One was attached to a telegraph wire here and another at Bellaire also. Other instruments were afterwards attached at Baltimore, Chicago and Newark, Ohio, and five persons conversed with much ease. The transmitter consists of a large box affixed to the floor, the speaker talking downward. The diaphragm is a cone of very fine aluminum wire, connected with a horse-shoe magnet, through which a current constantly passes from a battery. The employes of the company are reticent as to the reasons for the experimenting on the company's lines.

ELECTRICAL PATENTS

INDEX OF INVENTIONS FOR WHICH LETTERS PATENT OF THE UNITED STATES WERE GRANTED IN THE WEEK ENDING MARCH 9, 1886.

337,385 Electric regulator for pendulum clocks; Sylvester Eastman, Providence, R. I., assignor to the Synchronous Time Company, of Portland, Me.

337,416 Means for regulating pendulum clocks from a distance; George W. Millard and Joseph H. Clarke, Providence, R. I., assignors to the Synchronous Time Company, of Portland, Me.

337,417 Means for regulating pendulum clocks from a distance; George W. Millard and Joseph H. Clarke, Providence, R. I., assignors to the Synchronous Time Company, of Portland, Me.

337,418 Means for regulating marine clocks from a distance; George W. Millard and Joseph H. Clarke, Providence, R. I., assignors to the Synchronous Time Company, of Portland, Me.

337,419 Apparatus for regulating pendulum clocks from a distance; George W. Millard and Joseph H. Clarke, Providence, R. I., assignor to the Synchronous Time Company, of Portland, Me.

337,439 Fire telegraphy; Sidney J. Sanford, Barrie, Ontario, Canada.

337,477 Galvanic battery; Horatio J. Brewer, New York, N. Y.

337,513 Method or process of making wire cables; Arthur J. Moxham, Johnstown, Pa.

337,558 Armature for dynamo-electric machines; Carl Coerper, Cologne, Germany.

337,583 Secondary electric clock; Vitalis Himmer, New York, N. Y., assignor to the Standard Electric Clock Co., same place.

337,590 Telegraphic repeater; Joseph Kolzer, Dinsburg-on-the-Rhine, Prussia, Germany.

337,624 Underground conduit for electric wires; John J. Shillinger, New York, N. Y.

337,626 Signaling apparatus; Leopold Sell..er, Vienna, Austria-Hungary.

337,628 Regulator for dynamo-electric machines; O. B. Shellenberger, Rochester, Pa.

337,737 Electric arc light; Wm. F. Buckley, Cleveland, Ohio, assignor of two-thirds to L. E. Holden and Eugene H. Cowles, both of same place.

337,753 Diaphragm for telephone receivers; North Dowling, Philadelphia, Pa.

337,775 Regulator for dynamo-electric machines; Osborn P. Loomis and Henry W. Cooley, Lynn, Mass.

337,776 Regulator for dynamo-electric machines; Osborn P. Loomis and Henry W. Cooley, Lynn, Mass.

337,778 Electric motor; Osborn P. Loomis and Henry W. Cooley, Lynn, Mass.

337,777 Regulator for dynamo-electric machines; R. H. Mather, Windsor, Conn.

337,793 Electro-dynamic motor; Frank J. Sprague, New York, N. Y.

337,794 Electro-dynamic motor; Frank J. Sprague, New York, N. Y.

337,796 Electric mail box and indicator; Henry F. Staus, Chester, Pa.

337,797 Self-winding electric clock; D. Fred. Sweet, Grand Rapids, Mich. assignor by direct and mesne assignments to the Electric Time Co., same place.

337,803 Electric air pump; Albert B. Worth, Greenport, N. Y.

337,804 Electric air pump; Albert B. Worth, Greenport, N. Y.

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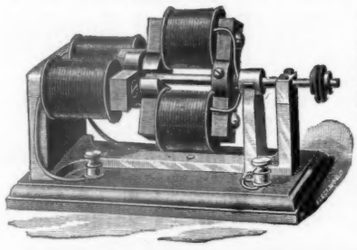

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EDWARDS H. GOFF, - - - - - - - - - - - - - - President of the Company, New York.
H. W. BURGETT, - - - - - - - - - - - - - - General Agent of the Company, New York.

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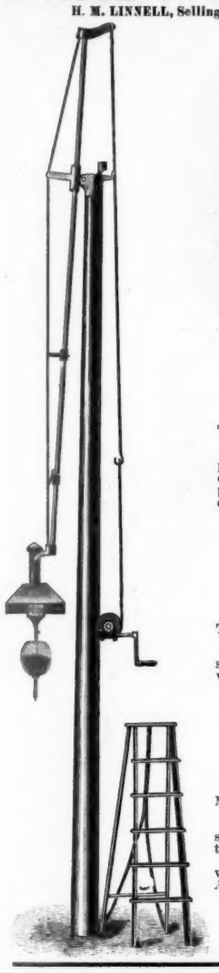


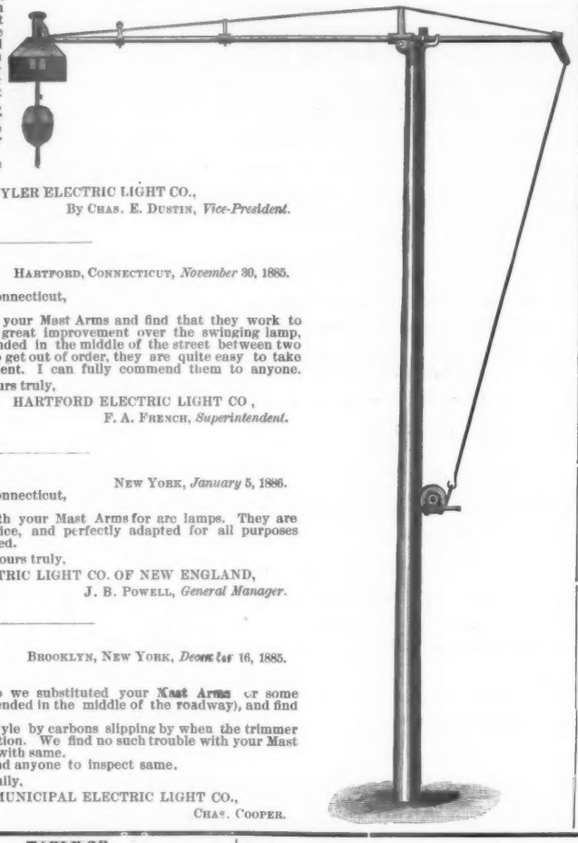
HARTFORD, CONNECTICUT, *December* 29, 1885

THOMAS H. BRADY, Esq., New Britain, Connecticut.

Dear Sir.—We take pleasure in giving you our experience with the Electric Light Mast Arm manufactured by you. We have had experience with mast arms manufactured by others and can unhesitatingly pronounce yours the best both as regards ease in working and permanent durability, of any we have used. In connection with this we will say that several of our workmen have invented mast arms that we could undoubtedly manufacture at a trifle less than we can purchase yours, but as an evidence of our belief that yours is the cheapest and best for us in the long run, we have sent you the order for fifty of your Mast Arms for the plant which we have erected for the City of Richmond, Va.

Wishing you every success we remain, Yours very truly,

SCHUYLER ELECTRIC LIGHT CO.,
By CHAS. E. DUSTIN, *Vice-President.*



HARTFORD, CONNECTICUT, *November* 30, 1885.

T. H. BRADY, ESQ., New Britain, Connecticut,

Dear Sir.—I have used several of your Mast Arms and find that they work to perfection and also that they are a great improvement over the swinging lamp, or, in other words, a lamp suspended in the middle of the street between two poles. They are much less liable to get out of order, they are quite easy to take care of, and are quite an ornament. I can fully commend them to anyone.

Yours truly,
HARTFORD ELECTRIC LIGHT CO,
F. A. FRENCH, *Superintendent.*

NEW YORK, *January* 5, 1886.

T. H. BRADY, ESQ., New Britain, Connecticut,

Dear Sir—I am much pleased with your Mast Arms for arc lamps. They are simple in construction, low in price, and perfectly adapted for all purposes where projecting lamps are required.

Yours truly,
THE BRUSH-SWAN ELECTRIC LIGHT CO. OF NEW ENGLAND,
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BROOKLYN, NEW YORK, *December* 16, 1885.

MR. THOS. H. BRADY,

Dear Sir.—Some few months ago we substituted your Mast Arms for some swinging lamps (i. e., lamps suspended in the middle of the roadway), and find them a vast improvement.

We were troubled with the old style by carbons slipping by when the trimmer was pulling lamp out to its position. We find no such trouble with your Mast Arms, and are very much pleased with same.

Should be pleased to have you send anyone to inspect same.

Respectfully,
MUNICIPAL ELECTRIC LIGHT CO.,
CHAS. COOPER.

Eugene F. Phillips, President. W. H. Sawyer, Sec. & Electrician.

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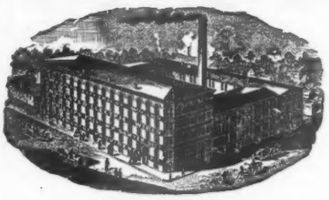

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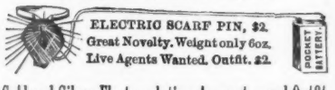

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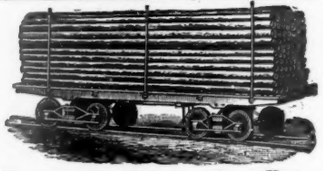

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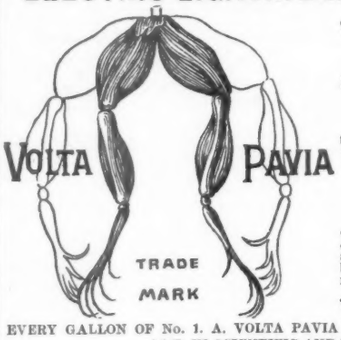

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TO THE PUBLIC.

EXECUTIVE OFFICES, MUTUAL LIFE BUILDING,
32 NASSAU ST., NEW YORK

NEW YORK, March 15, 1886.

The Consolidated Electric Light Company is the owner of many patents, some of which, issued to SAWYER & MAN, are believed to be essential to the operation of any electric lighting system.

Suits are pending against the leading companies for infringement of said patents, and they are being vigorously pressed against the Edison Company, because the controversy between SAWYER & MAN and THOMAS A. EDISON, in the patent office from 1880 to 1885, which resulted May 12, 1885, in the granting of a patent to SAWYER & MAN for "The Incandescing Conductor for an electric lamp, consisting of carbon made from a fibrous or textile material having the form of an arch or loop," disclosed the fact that

SAWYER and MAN had anticipated EDISON

more than one year in conceiving and perfecting the invention of the Incandescent Electric Lamp.

Notwithstanding the priority of these patents and the pendency of these suits, the Edison Company threaten the users of the Sawyer-Man system with suits for infringement.

This Company declines to engage in such warfare, but in answer to such threats it states:

First.—That the inventions claimed by Edison are those for which patents were previously issued to SAWYER & MAN, and which are involved in the suits now pending against the Edison Company.

Second.—That the Edison Company, notwithstanding such repeated threats, has never succeeded in obtaining a decree for the infringement of any of their said patents against any person or corporation.

Third.—That The Consolidated Electric Light Company is prepared to protect all the users of the SAWYER-MAN system of electric lighting in the full enjoyment of its privileges.

In stating the foregoing facts for the benefit of the public, and of those who are now and, for a number of years, have been using thousands of the lamps manufactured and sold under the Sawyer-Man system, this Company requests that any person who may have been induced to refrain from purchasing their apparatus, by reason of threats made by the Edison Company, will please communicate such fact to this office.

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The Brevoort Mfg. Co.,

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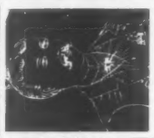

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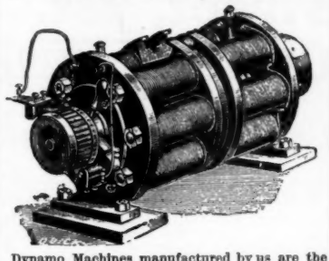

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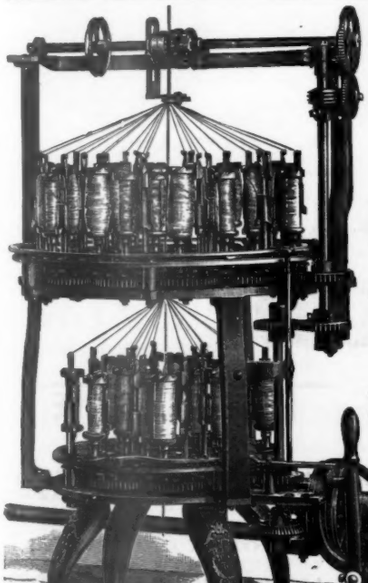

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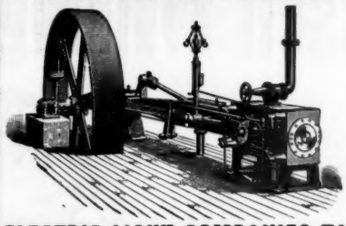

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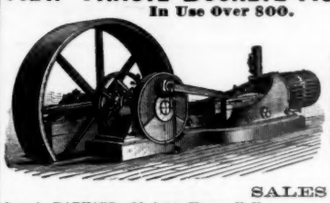

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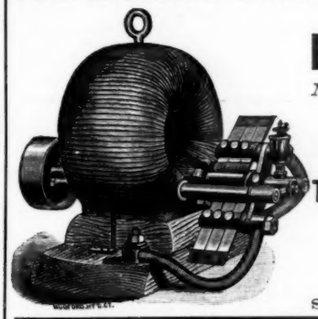

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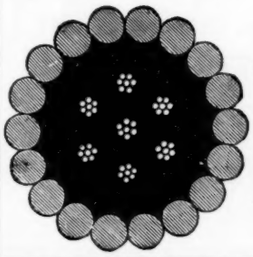

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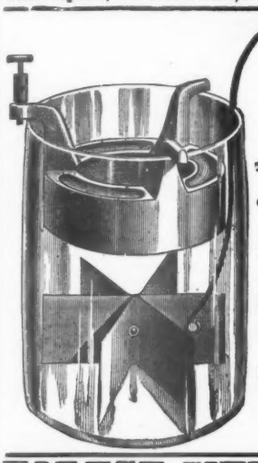

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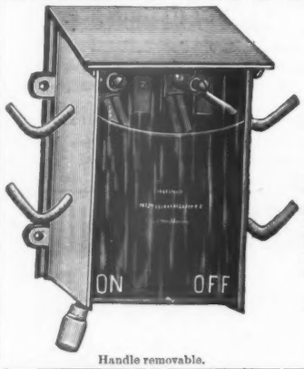

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